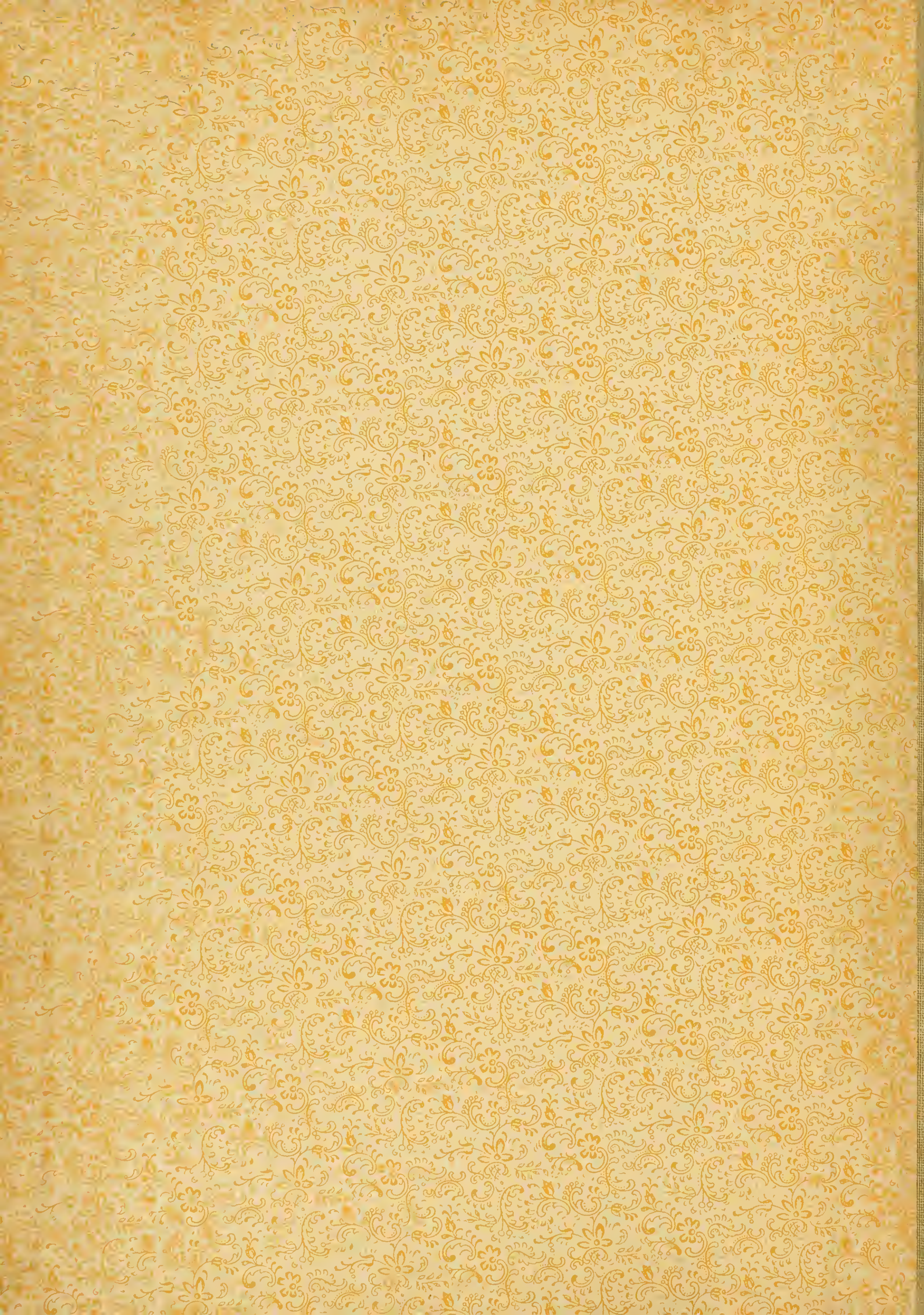

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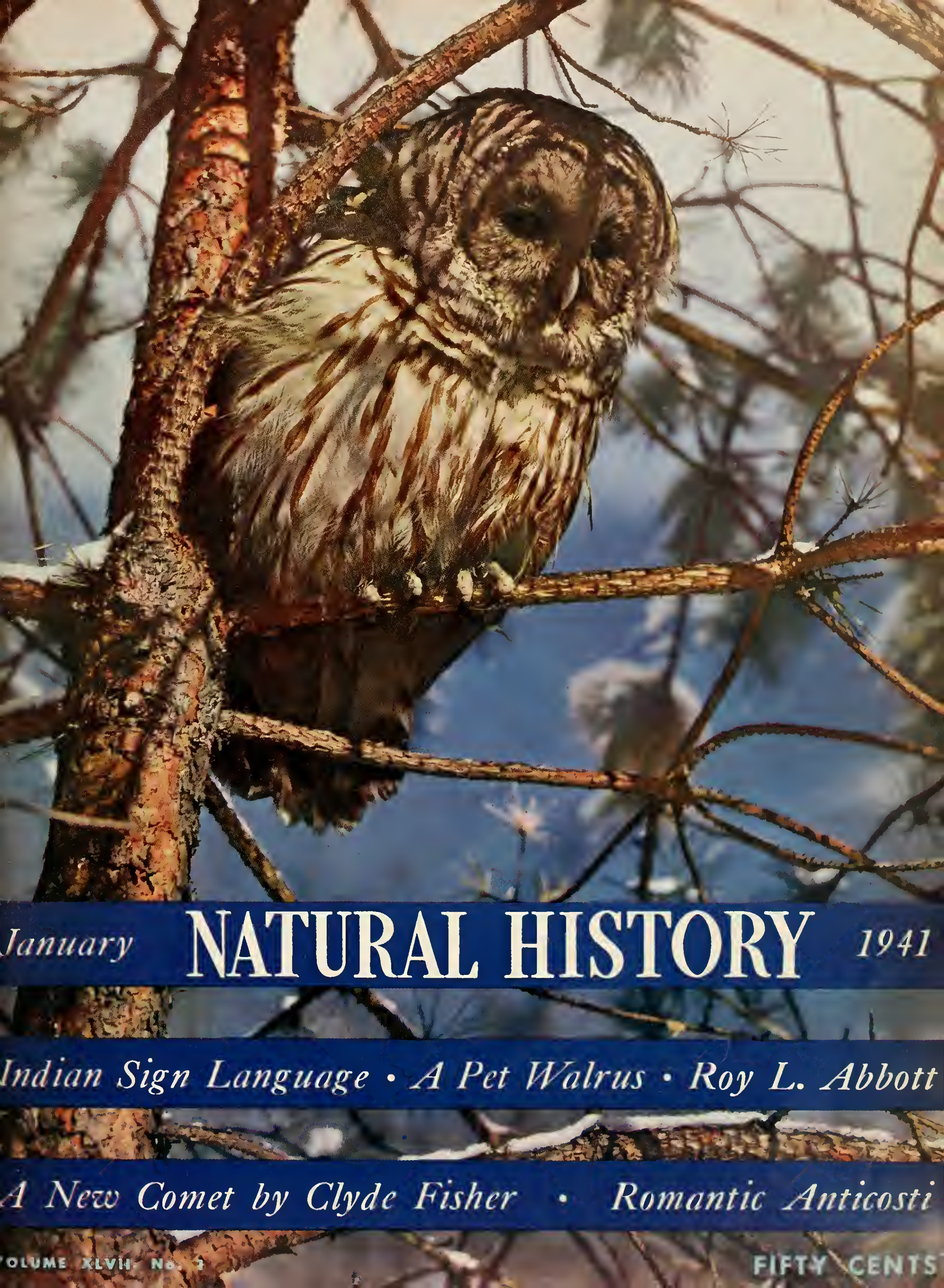

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LETTERS

Sirs:

Knowing of your interest in rarities, I present the accompanying photograph of a European fern which has mysteriously become naturalized in only one small spot in the entire United States. This is the European Hart's-tongue fern, *Phyllitis scolopendrium* (L.) Newman.

That one small growth of the fern should be found so far from its homeland is one of those riddles which add to the fascination of botany. How and from where it originated is unknown to the occupants of the farm on which it occurs, Mr. and Mrs. Theodore Lurman, who live near Darlington, Maryland, and to botanists who have visited the locality for years. I have traced its history back 80 years. It is supposed that the spores were accidentally imported with other seeds many years ago and have since been developed in the cool, dark, damp ram-pit (a type of surface well, about eight or ten feet deep, stone lined, with a spring in the bottom), where the fern has found conditions similar to its native habitat in Europe.

The colony forms a ring about three feet below the top of the ram-pit, with fronds hanging down from twelve to 20 inches in length. The fronds are evergreen and are protected from summer heat and drought and from winter freezing by a lattice covering the top of the ram-pit. Seemingly enough sunlight enters through the lattice to support the growth of this fern. There are about 80 plants in the colony.

This is the only locality known in the United States where the existence is truly accidental. Reports of two other localities in New York and northern Illinois respectively, each containing a pair of plants, are explained by the fact that the Brooklyn Botanic Garden sent out two specimens of it to persons who paid the postage. There is also a report of two from Iowa. But the Maryland site remains the only one where the fern has become naturalized and is flourishing. Specimens from this source can be seen in the herbarium of the Maryland Academy of Sciences, at Baltimore.

Clyde F. Reed,
Curator of Botany.

Maryland Academy of Sciences,
Baltimore, Md.

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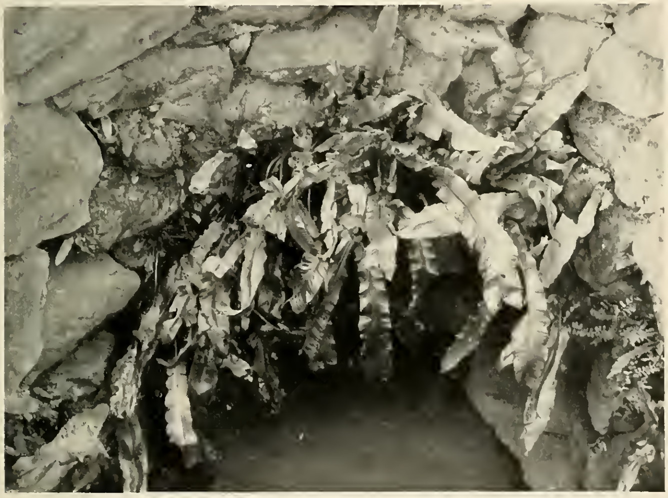

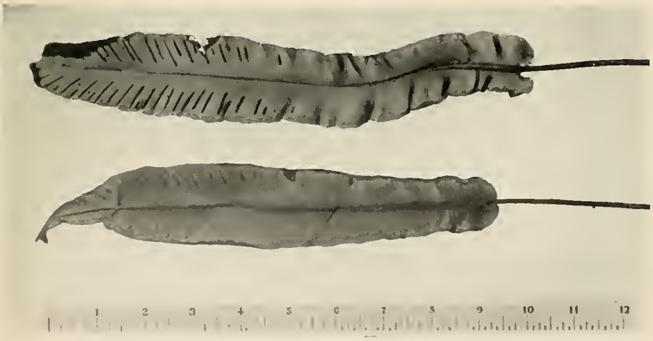

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LETTERS

Continued from page 1

Sirs:

I enjoyed your chart of the "World's Highest Waterfalls." You mentioned the fact that "many falls have had to be omitted from this chart for lack of accurate information." Certainly, every waterfall in the United States ought to have been recorded, and I think it is unjustifying to the highest waterfall east of the Rockies to be left out of that chart (Taughannock Falls of New York is not the highest). I refer to the Fall Creek Falls, a 256-foot falls in the Cumberlands of Tennessee. For further information on this falls, I refer you to page 577 of the May, 1939 issue of the *National Geographic Magazine,* where is found a colored photograph and description.

I hope this correction is mentioned in your next issue. I shall always remain an admirer of your magazine.

Bernie A. Bromka.

Carolina Sandhills National Wildlife Refuge,
McBee, South Carolina.

Sirs:

In sending you a membership renewal for our son, I am wondering if you may be interested in knowing that last year when we gave the magazine to him first he was not quite eleven years old, and the request for Natural History headed his Christmas list. We were sure it was too mature a magazine for him, but he was so very sure that it was just what he wanted that we yielded.

He reads it each month several times from cover to cover and then anxiously watches the mail for the next issue. He really loves it. . . .

We took him on his first trip to New York this fall, and the American Museum was definitely the highlight of the trip. . . .

(Mrs. Hugh W.) Marjorie W. Gregg.

Corning, N. Y.

* * *

Sirs:

On April 16, 1933, I found a nest of the South American condor (*Vultur gryphus* Linnaeus) in the mountains inland from Vallenar, Chile, South America. In the nest was a young male condor about four months old (shown in the photograph at left).

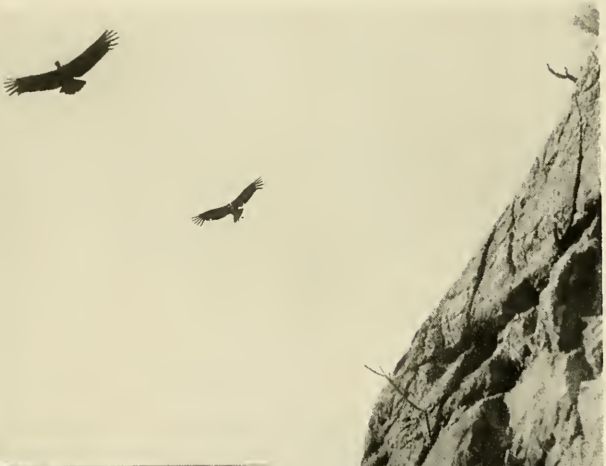
I was soon attacked by the two parent birds as I made my way up the cliff to the nest about 197 feet high. I was lucky enough to get a snapshot of both parent birds in the air with their outstretched legs ready to attack; the male is in the top left corner.

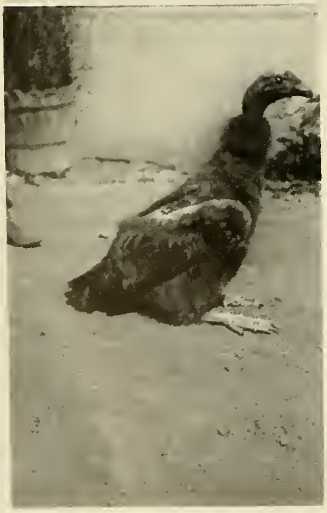
Although locally exterminated, condors are still found in the Andean mountains. They breed in large caves on practically inaccessible cliffs; their eggs are white and very similar to those of the California vulture (*Gymnogypts californianus*), measuring about four and three-quarters by two and three-quarters inches.

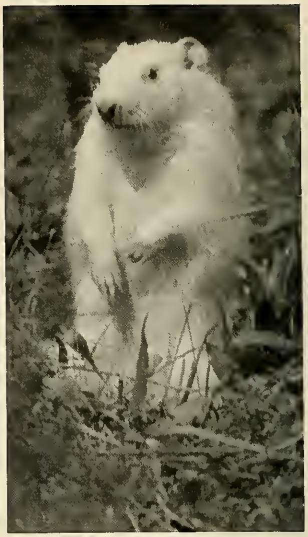
The young birds are clad in a soft brownish down for the first year and don't acquire full adult plumage until their third year.

Wm. R. Millie.

Vallenar, Chile, S. A.







Courtesy New York State Nature Association

Albino Woodchuck

An unusual photograph taken by W. J. Schoonmaker, of Rensselaer, N. Y.

Sirs:

. . . As my entire family greatly enjoys your magazine, I think it well worth keeping in good order, which your binders make possible.

Margaret Esther Lowenthal.

New York, N. Y.

* * *

Sirs:

. . . May I take this opportunity of saying how greatly your beautifully-produced magazine is appreciated by the members of the Ashmolean Natural History Society, in the capacity of librarian of which I have the pleasure of handling it?

G. E. S. Turner.

University Museum,
Oxford, England.

* * *

Sirs:

I rejoice in your beautiful magazine and find it a source of great value, diverting my mind from the halocaust in Europe. Through your articles on conchology, I have become interested in shells.

(Mrs. H. L.) Marian D. Woltman.

St. Paul, Minn.

* * *

Sirs:

. . . I enjoy Natural History so very much. It seems to become even more interesting as the months pass by.

Malvina Trussell.

Georgia Teachers College,
Statesboro, Ga.

Continued on page 62

THE MUSEUM AND SCIENCE

The history of life on the earth has been a record of the struggle of organisms to gain freedom from their environment. The rise of civilization has had the same basic motivation, a desire of people for real freedom.

Thomas Jefferson coupled freedom and science as conditions of progress. Every new discovery gives us added knowledge and a more precise orientation of ourselves to our universe. Science has been developed by man through the centuries to wrest an ever-increasing measure of order and security from the darkness and chaos about him. The giant Antaeus of Greek mythology was said to maintain his strength only by contact with Mother Earth. Civilization today is struggling to maintain its strength while weighted down by a complex superstructure of conflicting traditions and interests. We need to turn back to Mother Earth to regain perspective.

The Museum has always maintained research laboratories to discover Nature's truths and to demonstrate them to the public. Today fifteen scientific departments are hard at work. No less than 111 staff investigators and volunteers study the material gathered by our expeditions. As every corner of the globe becomes explored, our expeditions are returning to familiar places to study intensively with improved techniques the lives of the creatures there. Today we are concerned not so much with the rare or the exotic but with the dynamic factors which make individuals succeed under particular conditions.

We learn with the cortex of our brains, but our urge to get somewhere comes from the clenched fist or the instinctive part of our make-up. These instincts are very ancient, sometimes helpful but often harmful when misdirected. Even mother love can be detrimental when over- or under-emphasized. The Museum in recent years has sent expeditions to Polynesia, New Guinea and the East Indies to study the consequences of such maladjustments among primitive peoples. Further, it has maintained a modern laboratory where new techniques are brought to bear on the nature of our instincts. There is a chemistry of behavior, and some individuals, due to an inadequate environment or other misfortune, may be in serious need of new adjustments.

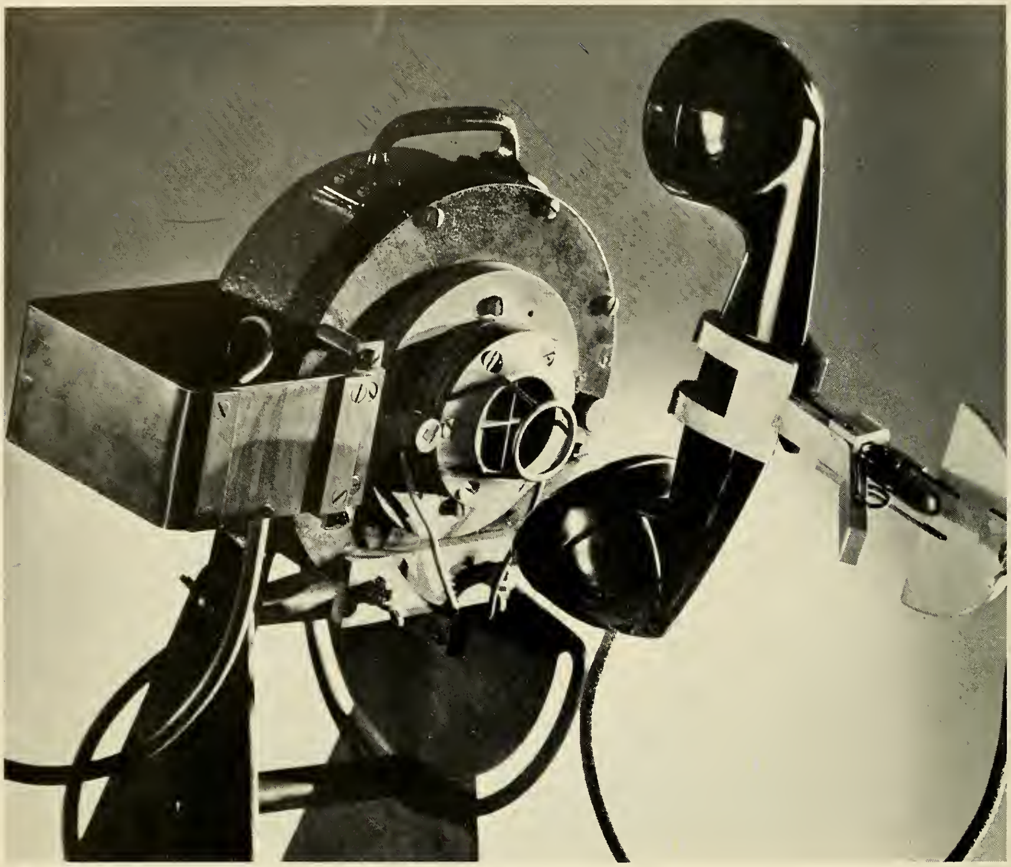
In animal societies the behavior of one individual may have a profound influence on the acts of all the others. Museum investigators interested in animal societies and in the laws regulating their behavior find that the supermind, the mind of the flock, has evolved in time and in accordance with natural laws. In these days of human mob action, these studies are particularly illuminating.

One of our major tasks is to investigate and recommend sound conservation methods. Natural science is not, however, a technique of conservation or a body of knowledge in regard to animal life. Rather it is an attitude of inquiry, observation and reasoning in regard to the world about us. As this science is reflected in our exhibition halls, so will the attitude of our youth be affected. It will train youth to observe, test and only then to theorize.

Progress in the world of tomorrow will be made not so much by changes in our bodily structure as by changes in our thinking. What happens in men's minds will determine what will happen in the world. The Museum, by bringing natural science, that is the truths of Nature, to the man in the street, is playing a major role in fashioning public opinion and aiding man's orderly and spiritual development.

G. Kingsley Noble

As NATURAL HISTORY Magazine goes to press, news of the untimely death on December ninth of Dr. G. Kingsley Noble, who wrote this editorial, brings the sharpest feeling of loss to the American Museum of Natural History and to the world of biology he so brilliantly served. His great work in exploring the frontiers of human knowledge and his vision to see beyond—both surpassing the measure of brief words—will persist through the years to come.



SAID THE ELECTRICAL MOUTH TO THE ELECTRICAL EAR . . .

"*Joe took father's shoe bench out. She was waiting at my lawn.*"

If you were passing through the Bell Telephone Laboratories today you might hear an electrical mouth speaking this odd talk, or whistling a series of musical notes, to a telephone transmitter.

This mouth can be made to repeat these sounds without variation. Every new telephone transmitter is tested by this mouth before it receives a laboratory or manufacturing O.K. for your use.

This is only one of the many tests to which telephone equipment is subjected in the Bell Telephone Laboratories. And there is a reason for the selection of those particular words.

It happens that the sentence, "Joe took father's shoe bench out," and its more lyrical companion, "She was waiting at my lawn," contain all the fundamental sounds of the English language that contribute to the intensity of sound in speech.

Busily at work in the interest of every one who uses the telephone is one of the largest laboratories in the world. The development of the telephone in this country is proof of the value of this research. In times like these, the work of the Bell Telephone Laboratories is especially important.

BELL TELEPHONE SYSTEM

The Bell System is doing its part in the country's program of National Defense

NATURAL HISTORY

The Magazine of the American Museum of Natural History

Frederick Trubee Davison, President — Roy Chapman Andrews, Sc.D., Director

VOLUME XLVII—No. 1 ★ ★ ★ ★ ★ ★ JANUARY, 1941

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From a Kodachrome by Henry B. Kane

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You will find Natural History Magazine indexed in *Reader's Guide to Periodical Literature* in your library

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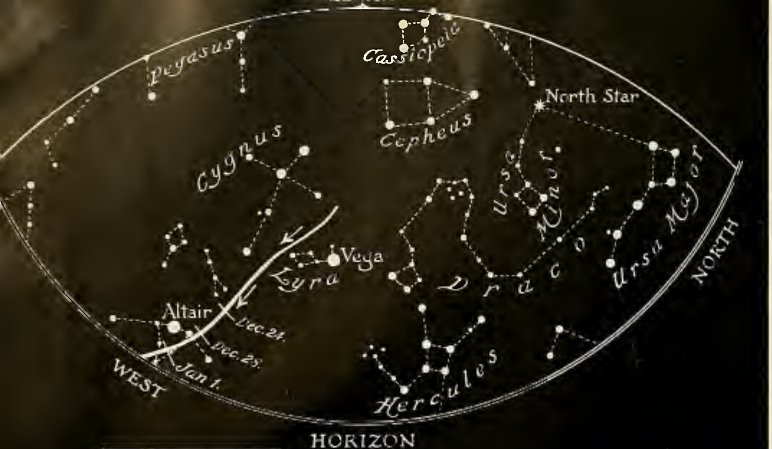

Pegasus
Cassiopeia
North Star
Cepheus
Cygnus
Ursa Minor
Ursa Major
Vega
Lyra
Draco
Altair
Dec. 24
Dec. 28
Jan 1.
WEST
NORTH
Hercules
HORIZON

TO FIND Cunningham's Comet, face the western and northern sky at 6:00 P. M. on January 1st, whereupon you will see the constellations as shown at left. Hold this sky chart in front of you and locate the Dipper, the North Star, and Cygnus, sometimes called the Northern Cross. Off the longer line of this cross, lies the bright star Altair, and nearby will stand the comet. Because it sets early, you must not wait long after sundown, and an unobstructed view of the skyline is necessary. The curved line shows the course of the comet, by dates. After January 11th, it will be a "morning star," as it were

Drawn by D. F. Levett Bradley from data by Hugh S. Rice

HALLEY'S COMET on May 12 and 15, 1910

Mt. Wilson Observatory photos

APPROXIMATELY 1000 comets are known which return toward the earth at intervals ranging from a few years to a million years or more. Below is Morehouse's Comet, photographed against the moving background of stars

Photo by Yerkes Observatory

A COMET IS HERE

The largest and brightest luminary of recent years spreads its glory in the western sky and recalls the dire portent which the ancients ascribed to these ghostly wanderers of space

By CLYDE FISHER

Curator-in-Chief, Hayden Planetarium, The American Museum of Natural History

From the time of earliest record, comets have been generally regarded as portents of evil; and they will always appeal to the human imagination because of their beauty and because some are the largest things in our solar system.

A comet was no doubt referred to in the Bible when "David . . . saw the Angel of the Lord stand between the earth and the heavens, having a drawn sword in his hand stretched out over Jerusalem"; and this was later interpreted by the historian Josephus as a forewarning of the destruction of Jerusalem.

When a comet appeared in 1681, a strange proclamation was issued in Switzerland admonishing all to remain in church for the sermon and to abstain from excessive carnival activities. Evening drinks were to be on a modest scale and to finish at nine, after which all were to go home quietly without shouting in the streets.

The comet of 1528 was described rather imaginatively by the father of French surgery, Ambroise Paré, as "so horrible, so frightful . . . that some died of fear and others fell sick." At the summit of it was seen the figure of a bent arm, holding in its hand a great sword, as if about to strike. On both sides of its rays, according to the eminent surgeon, "were seen a great number of axes, knives, blood-colored swords, among which were a great number of hideous human faces, with beards and bristling hair." A Greek word meaning "the long-haired one" is, indeed, the derivation of our word comet.

In this year we need no apparitions in the sky to remind us that all is not well on earth; and, in the light of modern science, we may give ourselves over to the pleasure of viewing one of the largest and brightest comets that have appeared in recent years with the assurance that any physical effects it will have on the earth will be quite negligible. Both scientists and laymen will watch this comet approach

---

(Below) DONATE'S COMET

From Harvard Annals

its maximum in January with all the interest that an event as rare as this commands.

Many will recall as I do the earnest desire with which they sought their first view of a comet. As a boy on a farm in the Middle West, I had the unusual privilege of using a good telescope of five and a half inches aperture. Through this I had seen planets, sun-spots, double-stars, star-clusters, nebulae, and the moon with its mountains and craters—but I had not seen a comet. Whenever the newspapers announced that a comet had been discovered, I would immediately write to the discoverer, or to some other astronomer, to tell him how very anxious I was to see a comet. I would ask the following questions, leaving space for his replies so as not to take more of his valuable time than necessary: "In what constellation is the comet? Near what bright star is it located? About what magnitude is it? In what direction is it moving?" The telescope to which I had access was not equatorially mounted, so I could not take advantage of the astronomers' coordinates for location.

Although I must have tried for three or four years before I succeeded in finding a comet in this way, no astronomer was so busy that he failed to answer my eager, boyish letters. It was not for lack of their sympathetic help that I failed to locate one earlier. In the first place, no naked-eye comet came along during this period. And the telescopic ones usually moved too near the sun or too far away, or cloudy weather interfered and postponed my searching until my directions for locating so fast-moving an object as a comet were of no use.

Finally, however, I did locate a comet in this way, with the help of the late Dr. J. G. Porter, then Director of the University of Cincinnati Observatory. This one happened to be Encke's Comet, one of Jupiter's family of about 50 periodic comets. This inconspicuous comet has the shortest period of any comet known—about three and a third years.

One never forgets his first comet. After my first, which was telescopic, I was quite lucky to see five fairly bright naked-eye comets during the first dozen years of the present century, one of which many may be surprised to know was visible in the daytime, namely Comet 1910a.

Prominent feature of sky

No telescope will be needed to see the present comet, for it will be a conspicuous feature of the heavens. A typical comet consists of a head and a tail, which together occupy such an enormous space as almost to stagger the imagination. The statement made by a prominent astronomer about a century ago "that a comet could be packed in a portmanteau" is not true, but the scattered material composing a comet would, if brought together, probably form a mass ridiculously small in comparison with the comet as we see it. The head of every comet is believed to contain a nucleus consisting of a loose mass of separate, solid bodies of iron or stone, in all essential respects the same as meteorites. It is true that the nucleus is not always visible, even through a telescope, but this is thought to be due to its small size and great distance. The tail of a comet consists of extremely tenuous material that is forced out of the head by the radiation pressure of the sun.

We have had few naked-eye comets during the past 30 years. The one that is now in the sky promises to be exceptionally bright. This comet was discovered by photography when it was much too faint to be seen with the unaided eye. The discovery plate was made on September 15th at the Oak Ridge Observatory of Harvard University, by Leland E. Cunningham. From the constellation Cygnus, popularly known as the Swan and sometimes as the Northern Cross, where it was discovered, this comet passed through the inconspicuous constellations of Vulpecula and Sagitta, and approximately on Christmas Day entered Aquila, the Eagle. On January 1st, it will be close to Altair—just a little way south of west of this first-magnitude star. By January 10th, it will have passed through Aquila into Sagittarius, the Archer. On January 11th, it will be in conjunction with the sun, after which date it will be a "morning star," as it were.

By January 19th, it will have reached its closest point to the sun (perihelion), when it will be about two-fifths as far from the sun as the earth, or about 36 million miles. At that time the tail will be millions of miles long. The longest tail of any comet on record was that of the Great Comet of 1843, which was nearly 200 million miles in length, considerably more than twice the distance of the earth to the sun. On account of the enormous size of the tail, occasionally a great comet is the largest body in the entire solar system, not excepting the sun.

When this new comet was discovered, it was more than 200 million miles from the sun, and at that time it had a sizable tail—one some 400,000 miles long, or almost twice the distance from the earth to the moon. As is the habit of comets' tails, it is expected to grow in length and size until the comet reaches its closest approach to the sun. At that time the head of the comet is expected to be as great as 100,000 miles in diameter, or more than ten times as thick through as the earth. Thus Cunningham's Comet, so named for its discoverer, promises to be the brightest and most striking one of these erratic wanderers that we have seen for 30 years and will be a spectacle which no one will want to miss.

How Dangerous Is the Jungle?

By C. SUYDAM CUTTING

Standing midway between the romancers and the debunkers, a world traveler and hunter makes illuminating observations on animal habits and gives shrewd pointers on how and how not to behave on safari

A GOOD way to improve one's knowledge of natural history is to look into some of the misconceptions that have arisen about the character of wild animals. For misconceptions, like bad pennies, keep cropping up in daily conversations, and our knowledge of animals must stand that test before we can go further. I refer not to wild animals seen along the length of a rifle barrel but wild animals as they exist under natural conditions. Our discussion will be limited to some simple observations, for I have never undertaken an exploring trip for the prime purpose of studying wildlife. But I have always been as much interested in the natural behavior of the wild animals I have hunted in Africa and Asia as in the actual sport.

For all the danger to the lesser animals, the jungle is a more tranquil spot that the romancers make out. The man who enters it for the first time may expect to see a congress of frenzied animals with a symphonic background of roaring lions, barking jackals, hissing snakes. Instead, he is surprised to find a vast silence, broken only by the cries of birds and the stridulations of insects. If he stays long enough, he may, depending on the region, hear a lion roar before starting off on a hunt, a hyena growling as if the sounds came from the depths of his bowels (the hyena's growl, contrary to legend, does not resemble laughter!), or a jackal barking his light, sharp note. Many animals will probably maintain a discreet silence.

The quietest time of all in the jungle is high noon, when the glare of the sun and the heat reach their greatest intensity. Most of the animals are probably sleeping. Even the birds and insects relapse into dead silence. Only the bees are inspired to greater noise and activity by the bright sunlight.

Late in the afternoon life begins to stir. Toward their various water holes, animals of all kinds begin their cautious descent. Whereas the ruminants want only a drink, the meat-eaters are yearning for dinner. The mortality curve rises at this hour.

The lion, tiger, or leopard will probably start his prowling toward the watering hole of lesser animals. The big cats are extremely agile but at the same time they are not in the market for any long distance runs. They first stalk their victims and then make a rush. When they get near enough to strike, it is all over for the victim.

TIGERS are hunted on elephant back or from a stationary tower. Dense cover and a dangerous, elusive quarry make it inadvisable to stalk on foot

Having killed, the big cats do not proceed to eat the entire carcass immediately. They eat a little, starting from the rear, and return later. A carcass left for 24 hours in the jungle is likely to become carrion. And carrion is what the big cats like.

Now and then a big cat rushes his prey and misses. In this event he is usually disinclined to give chase. Racing through the jungle or across the open plain is not to his taste. If he bides his time he will find something later with less effort.

Offhand one would think that the habit of leaving game for the morrow's meal would result in thefts and hence lead to fights among the big cats themselves. But the instinct of these animals is usually to eat their own kills and let the property of others alone, and they usually lie up near their kills.

The vulture "grapevine"

When the beasts have consumed their prey, the vultures take their turn. It has taken a great deal of observation to discover the secret spying methods of these birds. At the moment a beast makes a kill, the human eye is often unable to discover a single vulture either in the sky or in the surrounding trees. Yet within a few minutes, scores, sometimes a hundred birds, come wheeling down from the sky, to fall on their game—what is left of the animal.

Their system is simple. Spaced far apart in the sky beyond the range of binoculars, they are able to survey a wide stretch of territory. If one detects something promising, he swoops lower to have a look. One bird sees another swooping down, and curiosity moves him to follow. The signal spreads for miles around. The sky patrol, too high for human vision, operates very efficiently.

With possibly the single exception of the leopard, big cats are not in the habit of killing more than they can eat. This acts as a sort of safeguard for the lesser animals, for all can tell the difference between a hungry cat and a sated one. Once when I was in a machan (a high platform in the trees from which one observes game), I heard a sambar deer get near enough to a tiger to bell at him. The tiger in the neighborhood of his latest kill seemed in no hurry to start feeding. This reassured the deer, who kept up his belling for quite some time and then moved off.

In discussing life in the jungle I have said that the danger for a man is vastly exaggerated. Others have said this before me, and some have gone far enough to say they preferred a jungle, from a safety standpoint, to Fifth Avenue, New York, in the rush hour. I wouldn't go that far.

If there were no other reason to fear most jungles, there would be malaria. There are also scorpions, centipedes, stinging ants, and wild bees.

In Kohima, Assam, a swarm of wild bees once appeared on a tennis court while I was in the middle of a game. My partner called across in a peremptory tone, "Stand perfectly still! Don't budge!"

I obeyed, standing breathless for several seconds while the bees whizzed by only a short distance above. The queen was in the center, of course, and any gesture indicating danger to her might have brought the vast cloud closing in around our heads.

We have said a great deal to deflate the common, romantic idea of the jungle and the habits of wild beasts. But the fact remains that man-eating animals *do* exist. When lions, tigers, and leopards acquire a taste for man, they are terrible, relentless enemies. When a big cat shows a tendency to attack man, he is, of course, an abnormal animal, and it is often difficult to say with any degree of finality what caused him to become abnormal.

Many explanations have been given. A big cat, once wounded by a man, may develop an inclination to attack men without further provocation. By example the young may be taught to become enemies of man. Aged or disabled cats that find difficulty in slaying other animals may take to attacking human beings. Cats that have tasted human flesh seem more dangerous than those that have not. Many are the theories and difficult are the proofs. Case histories of wild animals, it stands to reason, are difficult to procure.

A distinction should be made between animals in the jungle and animals that wander afield near human habitations. When one reads that 3000 people lost their lives to wild animals in India during a single year and that 1600 of these were tiger casualties, there seem to be grounds for the notion that the jungle is as dangerous as the romancers make out. Actually the figures prove no such thing. Few of the casualties occurred in the jungle. The miscreant beasts were prowling near villages, many doubtless bent on stealing domestic animals. Their encounters with man certainly altered their natures. It is impossible to say how many of the attacks were unprovoked.

Selous, the most famous of big game hunters, who was killed in the Great War, said, "Any man who invites the charge of a lion is an idiot."

Tigers have a better opportunity than lions for declining further acquaintance with man. Whereas a green hunter, starting off in real lion country with the proper guidance, feels reasonably sure that his chances are good to get a lion, the tiger hunter has no such assurance. He may, as a matter of fact, undertake many shooting trips and never see a single tiger. Bigger and stronger than the lion on the average, the tiger is also more elusive. He is never seen in large numbers. His habitat is dense jungle and high grass. All in all, man and tiger meet less frequently than man and lion.

The density and height of vegetation in the Asiatic tiger country defies a hunter's vision. If he is on foot, views of the tiger are momentary and require a quick shot with very little time for a careful aim. Facing a wounded tiger in a jungle is a truly hazardous position. For this reason tigers are shot from the back of an elephant or from a machan which is set 20 feet or more above the ground. Natives of the tiger and lion country erect thornbush palisades to protect their cattle.

What has been said of the tiger applies also to the craftier and more courageous leopard. The same land usually harbors both animals.

Two ruminants who can be very dangerous because of their size are the bison and water buffalo. These animals, if wounded, may charge a man.

I learned something about the water buffalo during a shoot with Theodore Roosevelt, Jr. We were stalking a large herd in a vast, open dry swamp in French Indo-China. Because there were no trees and the grass was too short, we had inadequate cover. The herd sighted us. Instead of moving away or stampeding, they turned and faced us, with their leader out in front. At that time we were shooting with a Frenchman named De Fosse who had lived in Indo-China for a long time and knew the habits of the water buffalo. Instantly he perceived danger. "If the leader makes for us," he said, "the whole herd will charge at us blindly. They have no purpose of their own, a mere blind impulse to follow the leader. All of us must fire at the leader."

We lifted our guns. We fired. Two animals fell. There was a breathless pause while we waited to see if there would be a charge. But the noise of the guns terrified the entire herd. They stampeded away from us.

In South India I had an experience with the bison, or gaur, of that country. Once a solitary bull was wounded and he escaped into the jungle. We had to follow him for more than a day before finishing him off. My companion on this pursuit was Randolph Morris, a coffee planter, with whom we were staying. He knew the habits of the bison, and it was under his direction that we moved forward with infinite care from tree to tree. Twigs, dry leaves, and clumps of earth were daubed with the bloody footprints of the wounded beast. The jungle interfered with our vision. While we could always follow the animal's path, we could not gauge his proximity. From time to time we threw stones into the dense thicket in order to locate him.

Hour after hour we followed the bloody track. Once we got within 50 yards of the animal. Morris had decided it would be too dangerous to invite the frontal attack of an animal weighing almost 2000 pounds. A way had to be found to divert its attention.

When we found ourselves in a tiny glade not far from the animal, Morris tossed a knife, hoping the enraged bison would charge it and give us an aim. He threw it too far. The knife landed in thick jungle out of our sight. But suddenly we heard a snort, a bellow. The 2000-pound beast was crashing through the jungle. Our native servants were terrified and clambered up the nearest trees. Just at this minute I looked up. An enormous red and black squirrel, four feet long, went springing from treetop to treetop with such speed that he seemed to be flying. Then there was silence once more.

This failure meant many more hours of stalking. It was not until the next morning, as a matter of fact, that the bison was brought down.

These instances prove but one thing, that the bison and water buffalo are disposed to charge, given sufficient provocation. The word "provocation" is important. These two ruminants, along with the big cats, have been taxed with a fundamentally hostile attitude toward man. But often it is man that starts the trouble.

Attack without provocation

I can name two animals, however, that will attack a man without provocation. They are the Asiatic sloth bear and the rhinoceros. Up to the moment no mitigating circumstances have been found for them. The king cobra is also supposed to attack without provocation. But on the whole, snakes are much maligned.

We have named three out-and-out aggressors. But this is not such a formidable list when we consider the legends of evil behavior in the animal kingdom.

In American folklore a great deal of mischief has been imputed to the wolf and the eagle. Let us consider the wolf's case. The United States Biological Survey disposes of two legends. American wolves do not hunt in large packs and they do not attack man. The most they achieve in the way of communal organization is the hunting of smaller game in small groups. Man they let alone. On the other side of the wolf ledger there are plenty of cases where

Asiatic and European wolves *have* attacked men.

The stories about the eagle's exploits usually spring from an exaggerated idea of the bird's strength. It is true they will swoop down and snatch rabbits, hares, and even young lambs. But eagles which seize children belong in mythology. Among the natives of northern Chinese Turkestan, incidentally, the eagle is sometimes used for coursing. The bird is let loose at gazelle. Left to his own choice, he would not ordinarily attack such a big animal since he could never hope to carry it back to his aerie. But he has been well trained. He knows that if he can knock down or impede the animal in his flight, mounted sportsmen will soon ride up to dispatch it.

By this time it has become reasonably clear that in most conflicts between man and beast, man is the aggressor. From earliest times man has hunted—as a means of procuring food and for skins to protect his body against the elements. He has left a legacy of fear with the animals, and the fact that some of them when injured or menaced will fight back is not in the least surprising.

One curious phase of man's relation with the animals is the process of domestication. Although all the domestic animals we know today were originally wild, the transformations all took place in prehistoric times. There is no written record of any animal's being domesticated in modern times, except the African elephant. And whether we are to call the African elephant a domestic animal is a moot point.

We have seen that wild animals are inclined to flee from man. Certain animals enjoy special advantages, such as speed and cunning, in avoiding human contacts. Others are well protected because of their isolated habitats.

In my experience the most exhausting kind of hunting is provided by the anoa of Celebes, the panda of Chinese Tibet, and the ibex of northern Ethiopia and of the Tien Shan Mountains of China.

Even to approach the Simen Mountains of Ethiopia or the Tien Shan range requires tremendous effort. Crags and precipices at lofty altitudes are the habitats of the goat. The chances are against the hunter's even seeing game, to say nothing of shooting.

The panda inhabits a mountainous region, dense with dwarf bamboo. Not only is visibility bad but the ground is usually covered with mud so that the hunter must constantly guard against falls. Silent stalking is out of the question: the bamboo cracks and breaks so that the panda is forewarned.

The anoa or dwarf buffalo of Celebes lives in steep, hilly country, protected by dense jungle. Merely to cut one's way through this jungle requires terrific labor. Thorns reach out to scratch the face and tear the clothes. Visibility is usually limited to a green wall a few feet away.

Tiger hunt

I should like to tell of a tiger hunt carried out in Nepal, in the district of Kheri. This hunt, to which I was invited by Kunwar Dillipat Shah, brother of the Maharani of Kheri, was interesting because it showed something of the tiger's characteristics and emphasizes the trait I have stressed—the desire of the big cats to avoid trouble.

The first step was to tether native cattle to trees in the jungle. The forest officer was aware of the approximate number of tigers in the district, having acquired the information from native forest rangers, who seemed to know everything going on in the jungle. When a tiger or leopard had made a kill, the facts were reported to us the next morning by the ranger. Preparations were immediately made for a hunt. The tiger or leopard, after killing a calf, would invariably drag it a short distance away, sample it, and then go away for a while. Until he felt disposed to return and finish his meal, he would in all likelihood remain in the vicinity of the kill.

There were two periods of the day when hunting was feasible. One was the early morning shortly before sunrise, when there was barely light to see one rifle sight. The other was in the heat of the day, when the animal would be lying in some thick, densely shaded spot and could be driven out by a line of elephants. The middle of the day was the better time because it gave us better visibility for shooting. (We hunted both tigers and leopards in exactly the same way.) It was not necessary to hurry, for we knew the tiger would probably be somewhere in the vicinity of his kill all day.

We had twelve elephants in the line, which gave us a beat of considerable breadth. The breadth varied so much depending on the nature of the terrain and the proximity of the tiger, that it was difficult to estimate its mean. Perhaps it was never less than 150 yards or more than 300.

The beat moved through high ratwa and nurtle grass, which sometimes grows as high as the howdah (the commodious railed, canopied seat on the elephant's back). Should a tiger sleeping in the grass be startled by our beat, his natural tendency would be to move on ahead of us. But cases have occurred where a tiger, driven out of his refuge, broke back through the line of elephants. Great precautions had to be taken to keep the elephants close enough together to frustrate any such move; for swinging around to shoot from an elephant's rear is difficult.

As long as we could drive the tigers in front of us we had no fear that they would disappear "into the blue" like deer or antelope. Tigers, like all big cats, will not run far. They have a short temper and no running endurance. It is true one may lose them, but the explanation then would be that they had turned or doubled and were again secreted in a spot where the beat would just miss them.

The tiger as a species was originally a cold weather animal. The Indian tigers of today are supposed to have descended from Korean, Manchurian, and Central Asiatic stocks. The reason for the migration seems to have been the more plentiful game afforded by the hot countries.

The tigers in our area were not fond of heat. As soon as the sun was fairly well up from the horizon, they chose a densely shaded spot wherein to lie down.

With twelve elephants in line, a considerable area could be covered; and since we continued beating as long as the light permitted, our chances for discovering a tiger were excellent. All during the beat the line tried to comb those places where the grass was highest and the jungle thickest.

This difficult and highly technical show was managed by the Kunwar with consummate ease. He used gestures. He spoke in a soft, gentle voice. Occasionally he whistled. Men and elephants were instantly responsive to his signals.

There were no dull moments during the hunt. We never knew when a tiger might appear. But we did know that a bad shot might cause the tiger to charge at an elephant and maul him. An elephant cannot abide the smell of a big cat. Seeing a tiger, he will always trumpet and raise his trunk and curl it over his head, for he knows how vulnerable he is to a tiger's claws. Because a tiger can leap very high, accidents do happen. However, keepers always take great care to dress their elephant's wounds.

Although we had twelve elephants we did not have a rifle on each. Three or four rifles among the lot was considered a fair number. Each of the elephants carrying a rifle also carried a howdah. The other elephants, merely assisting in the drive, each carried the *mahaut* (keeper) and one or more other natives.

The *mahaut* always sat forward of the elephant's shoulders. His knees were curved around the animal's ears, and his feet dangling downward gave the signal for every movement. The other natives sat on a large pad fastened to the elephant's back by ropes. These ropes provided them with a grip when the going was rough.

Shooting from a pad elephant is not uncommon. The hunter, sitting directly behind the *mahaut* and facing due forward, has two means of traversing his rifle, right and left. For general shooting, however, the howdah is preferable. This is a comfortable perch and is large enough to accommodate an extra kit of guns. For the sake of steadiness one usually stands up to shoot from a howdah. Hunters find it better to lean against the front rail for greater steadiness. Before any shooting is done, the elephant is brought to a halt, but even so there is apt to be some motion, for he may suddenly shift weight from one foot to another. Even his breathing may make the bead on the front sight a little wavy.

One morning word was received that two tigers had been spotted. One had made a kill the night before. We started off immediately. After an hour's beat we arrived at a dry swamp covered with nurtle grass. This grass was so high it covered the heads of all our elephants.

The morning was well advanced. It was very hot. The grass gave the tiger an excellent shelter against the sun. Advancing slowly, we roused many wild pig and hog deer from their noonday rest. Everyone was tense. Those with rifles were standing at the rails of the howdahs, staring straight ahead.

In a situation like this the first intimation that a tiger is near comes from the trumpeting of one or more elephants who have winded him. Although tigers and elephants are not natural enemies and usually leave each other alone, elephants, particularly females, are always afraid of tigers and, therefore, quick to sense their presence.

One of our elephants trumpeted. Soon after, we were able to locate our quarries. Their path could be traced by a ripple along the tops of the grass. Shooting was, of course, out of the question till the tigers could be driven out of the grass and into the bordering jungle where a proper view could be obtained.

The tigers advanced at first in a short series of slow movements. Then one of them broke to the left and passed safely beyond the elephant at the farther end of the line. No one saw it emerge from the grass. It was never seen again.

We concentrated on the other. Finally we saw him emerge at the end of the grass bordering on the jungle. One yellow-striped flash and he was gone. But we were sure he would not run far. If we were persistent in our driving, we would soon see him again.

It was slow work. The jungle vegetation, streaked with light and shade, made it difficult to pick out the tiger. But shortly before the light began to fade, we spotted him. A heavy rifle roared just once, and the tiger lay dead on the ground.

(Left) THREE VIEWS of a tiger hunt in northwest India showing the types of terrain where the striped one may lurk. Though tigers and elephants are not natural enemies, the latter cannot abide the smell of any big cat and usually give warning by trumpeting. Sometimes their keepers must dress gashes which the terrible claws of the high-leaping tigers leave even in the pachyderm's tough hide. The tiger is bigger and stronger than the lion, and more elusive. His nature is altered by encounters with humans near villages. Attracted by domestic flocks, he is thrown into conflict with their owners, and casualties are sure to follow. Thus it is in or near the pasture or plantation, not in the jungle, that he acquires his taste for man

(Above) THE HIMALAYAS: a view of their northern side where the author hunted mountain sheep. At top right, the author's camp in southern Tibet is shown, and *(below right)* his caravan traversing wild ass and gazelle country in the same region

All Photographs by the Author

There were several days of the hunt when we received no reports of tiger or leopard. All hands then went out on the elephants to shoot whatever they could. The game on such days included swamp deer, black buck, alligator, chital, hog deer, partridge, pheasant and peacock. We never shot at these when we were out after the big cats, for at such a time the sound of shooting might have frightened them away.

No one could say that comforts and conveniences were lacking on the hunt. We lived in large, firm tents. One pad elephant carrying our lunch always traveled along with us. Out in the open, in the bright sun, it was very hot, but with the jungle always at hand and clumps of trees about, one could easily find shady retreats in which to rest. Our luncheon hour varied greatly, because on the tiger or leopard days we never stopped till we had bagged the quarry or lost it for the day.

All in all our shooting trip netted two tigers, two leopards, and a crocodile, besides the smaller game already mentioned.

One last word about elephants. In our hunt they were so careful of their footwork, so indomitable in pushing through difficult spots of the terrain, that we were able to scour the tiger country quite thoroughly. Their bulk was an aid rather than a handicap in plunging through the jungle. Their great trunks tossed logs aside, pulled saplings up by the roots, and tore boughs from trees. In dealing with any impediment, their trunks showed almost manual dexterity. A sure and subtle understanding existed between every elephant and its *mahaut*. As a matter of fact, the *mahaut's* language is a special dialect incomprehensible to the layman.

In return for their services, the elephants were given particular care by their keepers. They required, for instance, one bath a day in order to keep their skins healthy. The bathing and scrubbing in the stream near the camp was a regular ritual. It was an engaging sight to watch the great beasts lie down docilely and allow the natives to give them a thorough scrubbing. For a brush the natives usually used a good brick which was not too rough for the elephant's thick hide.

This tiger hunt belonged to an elaborate type that takes place at rare intervals. The average man in India does not possess twelve elephants; if he did, he would find more productive uses for them than tiger hunting.

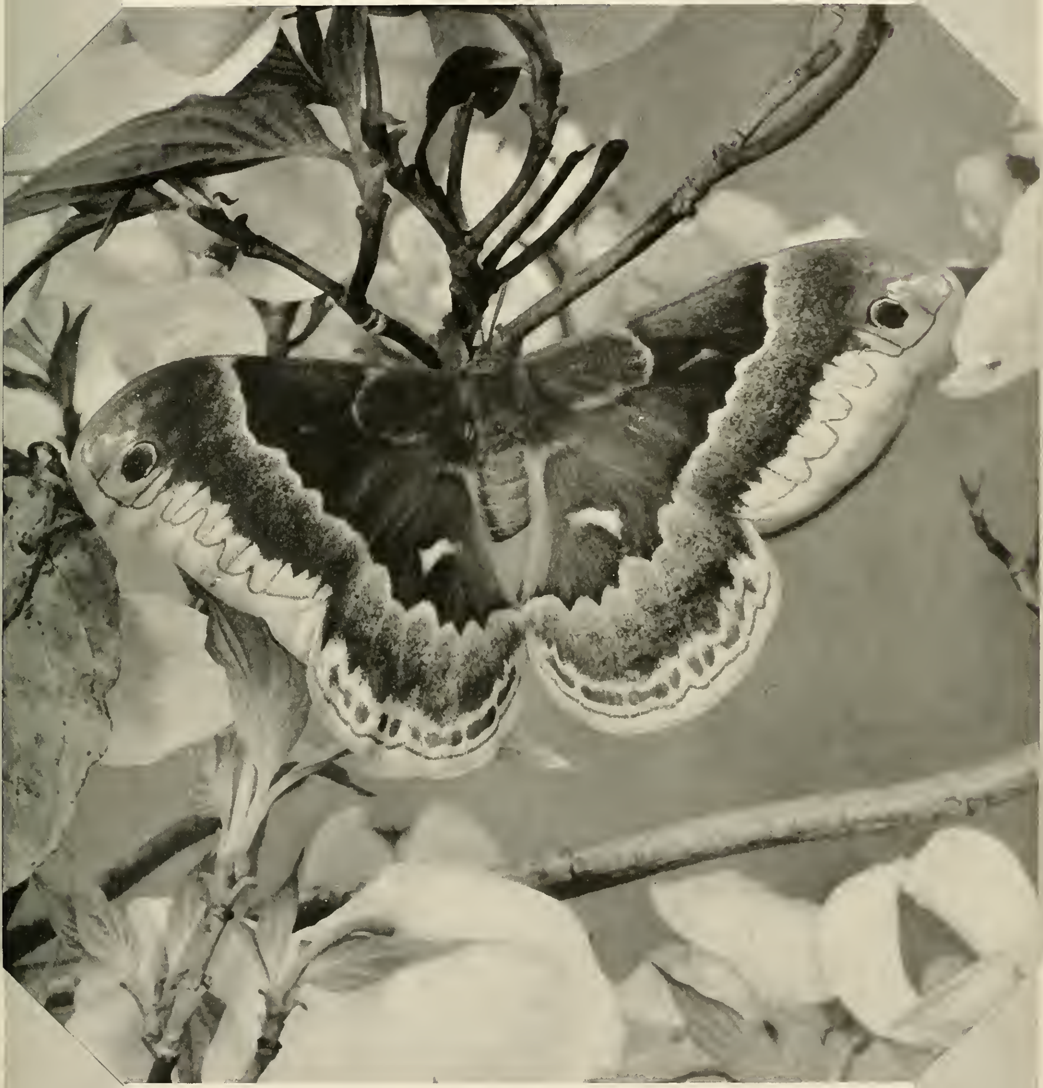
A tiger district, as I have indicated, is not precisely overpopulated with tigers. One does not hunt them in a random way as one might hunt deer. A machan is erected only when tigers are known to be in the immediate vicinity. If a tiger leaves a natural kill, the machan is put up nearby. If no natural kill has been discovered, a bait is provided in the form of a live domestic animal. In any case, when hunters climb into a machan they must be prepared for a long and tedious wait.

Machans are designed to provide a maximum of safety for the hunter. Tigers have been known to jump higher than fifteen feet, so the average machan is around 20 feet above the ground. Tigers, in common with other animals, seldom look up. They find nothing of interest in the skies and treetops. If their attention is drawn to the machan by the slightest noise, it is another story.

When man meets tiger, or for that matter any wild animal, it is usually man who takes the initiative.

MEASURING the head of a water buffalo taken in Indo-China. The water buffalo is one of the most belligerent of the ruminants. Given sufficient provocation, he will charge at top speed. But whether he is fundamentally hostile toward man is a debatable point

AN AMERICAN SILKWORM



A Story in Pictures by HENRY B. KANE

Millions of yards of silk produced annually by Nature in the United States prove that, if ever the need arises, we have scarcely begun to realize the full benefits of the insect world

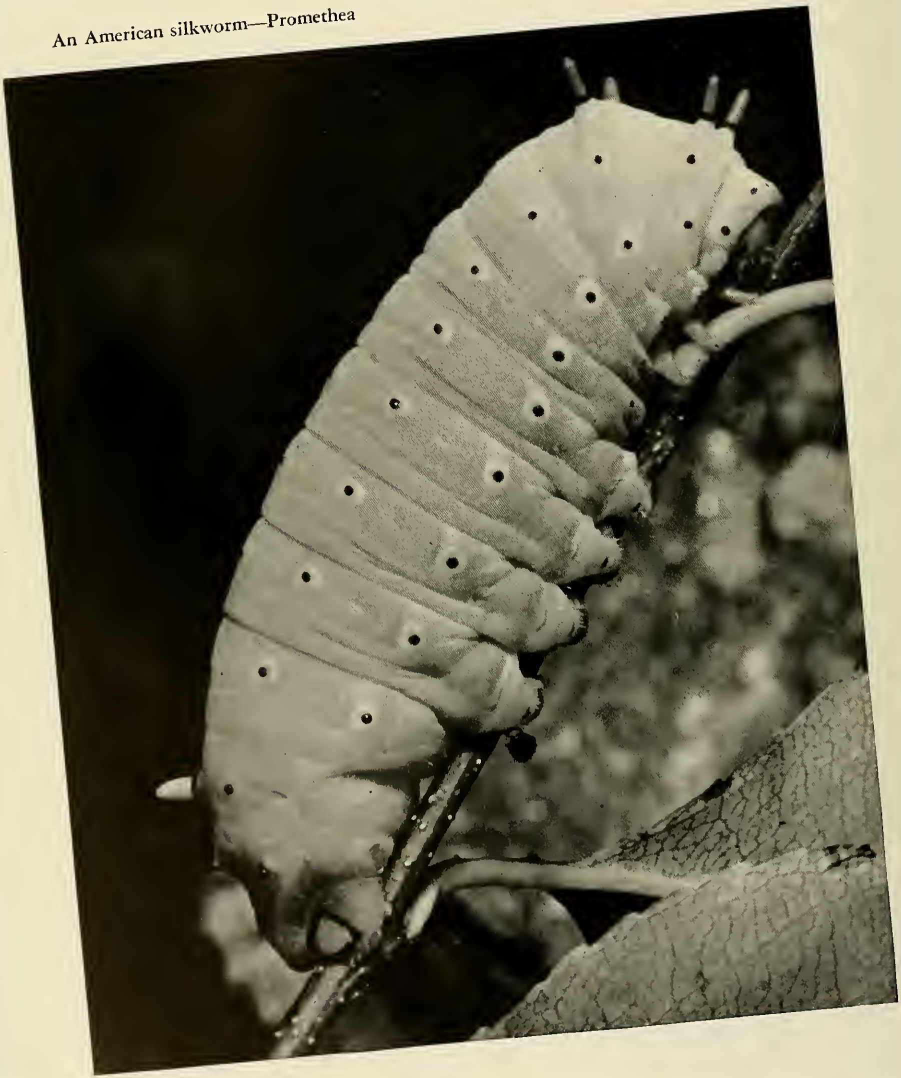
THE SILKWORM of commerce is one of the two insects which man has domesticated—the other the bee. We commonly think of the silkworm as being essentially a Chinese insect; yet here in the United States we have a whole family of Giant Silkworms. Literally the woods are full of them, from the Atlantic to the Pacific.

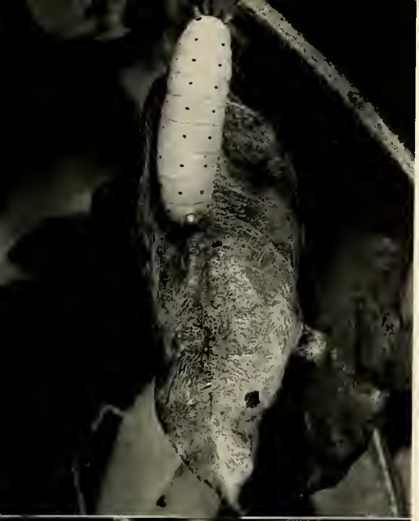
The silk spun by some of them is comparable in quality with that of the cultivated silkworm, though somewhat coarser. Various ill-fated attempts have been made to use it commercially. The main drawback is the high cost of labor. American labor cannot possibly compete with the peasants of Japan, China, Spain, and Italy.

The Giant Silkworms are caterpillars of our largest night-flying moths: Cecropia, Polyphemus, Luna, Cynthia, Promethea. The first two have the best silk; all have the same method of production. These remarkable photographs show a Promethea spinning its cocoon, a sight rarely seen, for although the caterpillar is large (two inches long) it is leaf-green and scarcely distinguishable from the foliage on which it feeds—cherry, ash, sycamore, and many others.

The caterpillar hatches from an egg, sheds its skin several times as it grows, finally reaches full size. After it ceases eating it looks for an acceptable leaf and spins a cocoon, wrapping the leaf about it. Inside it sheds its skin for the last time, becomes a pupa, emerges three weeks later (or if it is fall, the following spring) as a huge moth measuring up to four inches across the wings. Cecropia, our largest native moth, may measure about six inches across and is often mistaken for a bat at dusk.

An American silkworm—Promethea





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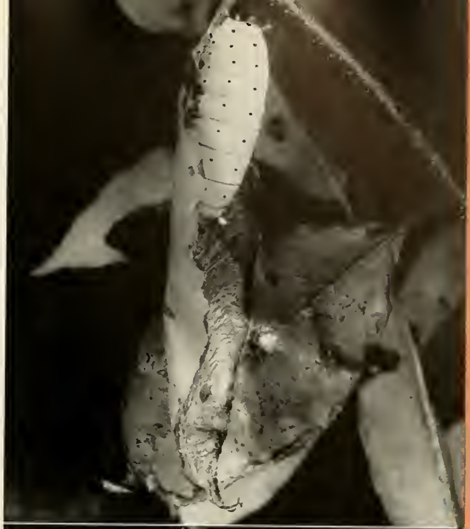
The leaf is
covered with
silk—



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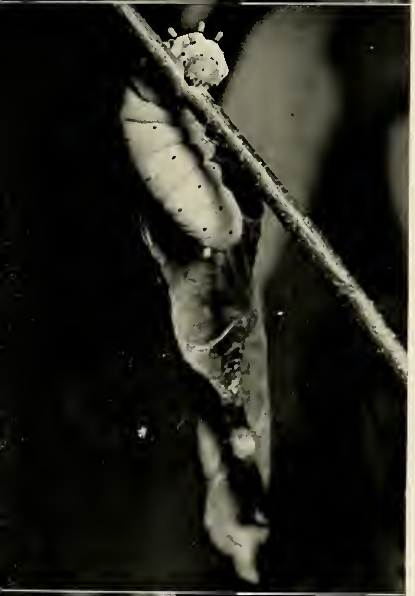
and starts
to curl



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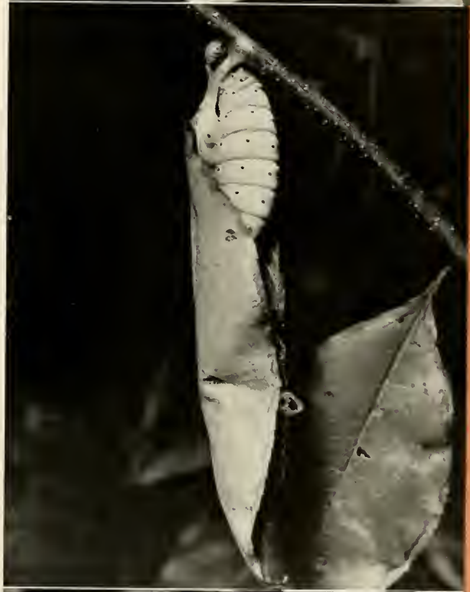
It is anchored
to the twig—



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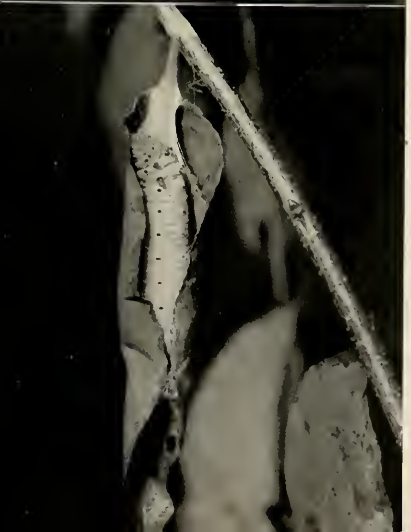
so winter
winds can't
blow it off



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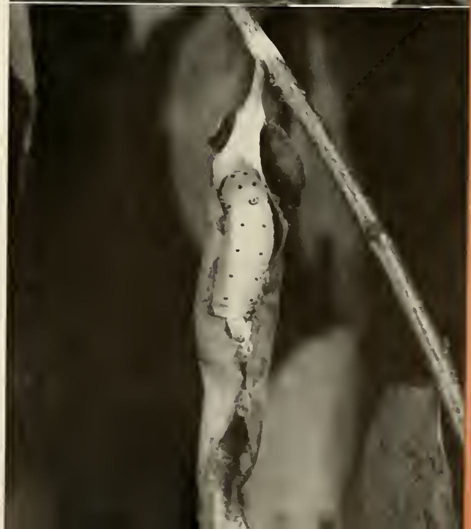
The silk lining
is thickened



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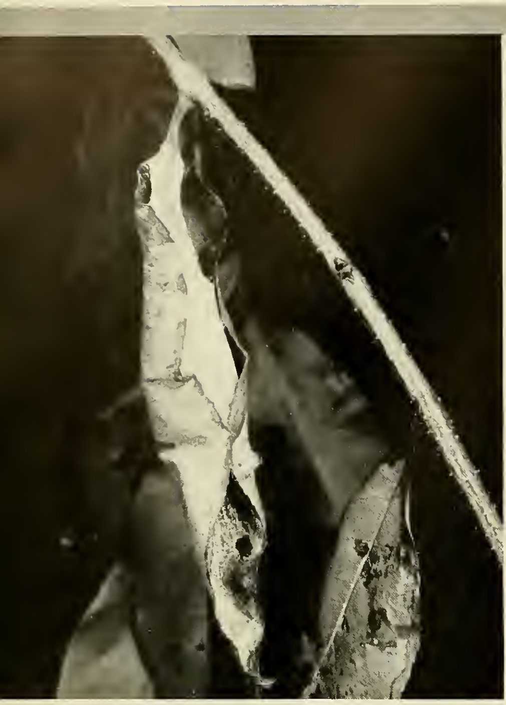
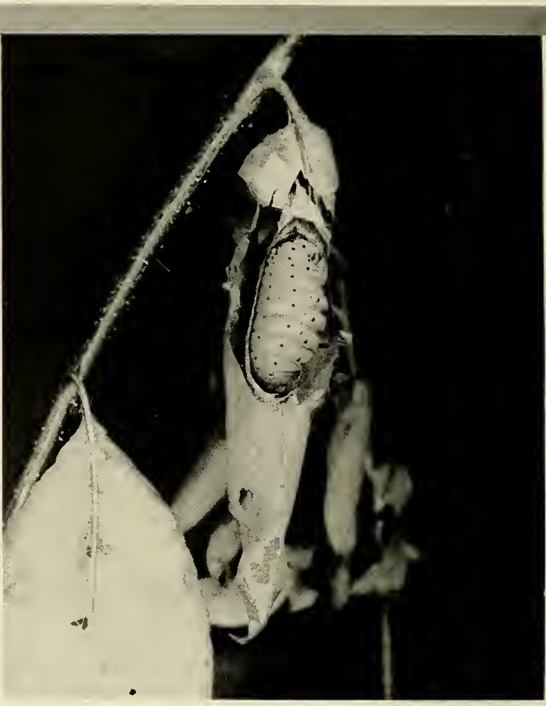
The silkworm
closes up the
bottom—

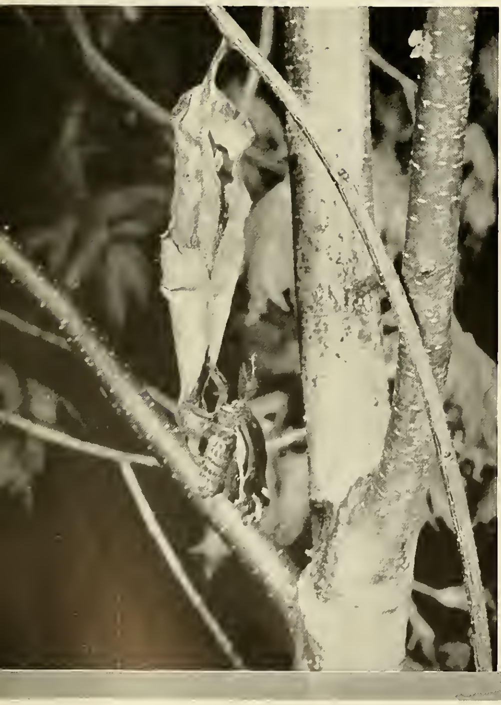


and the cocoon is completed

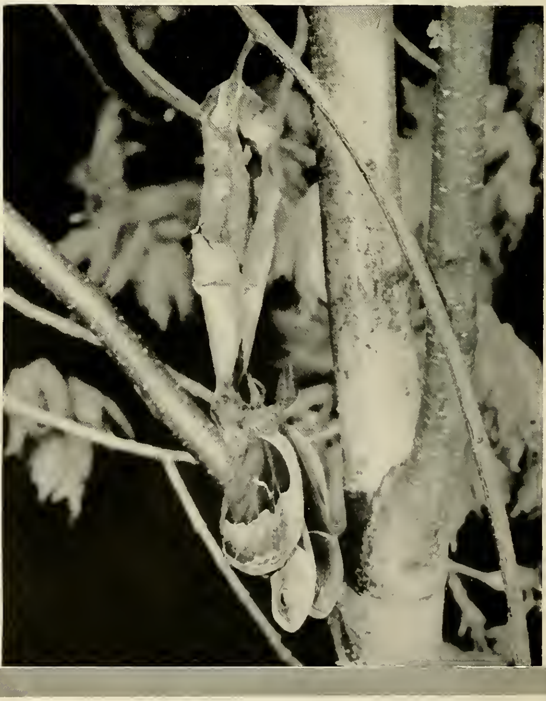


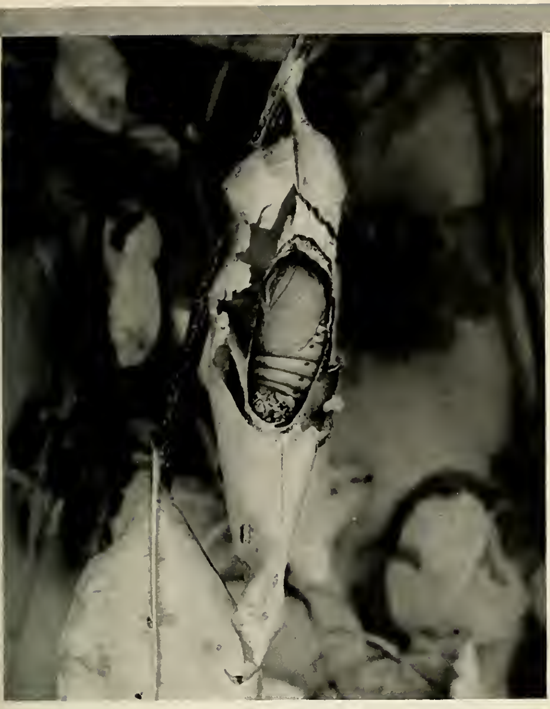
Body shrunken, it waits to shed its skin to become a pupa
(section of cocoon cut away)

In June the moth emerges, wings still unexpanded



The moth hangs here for an hour or so—

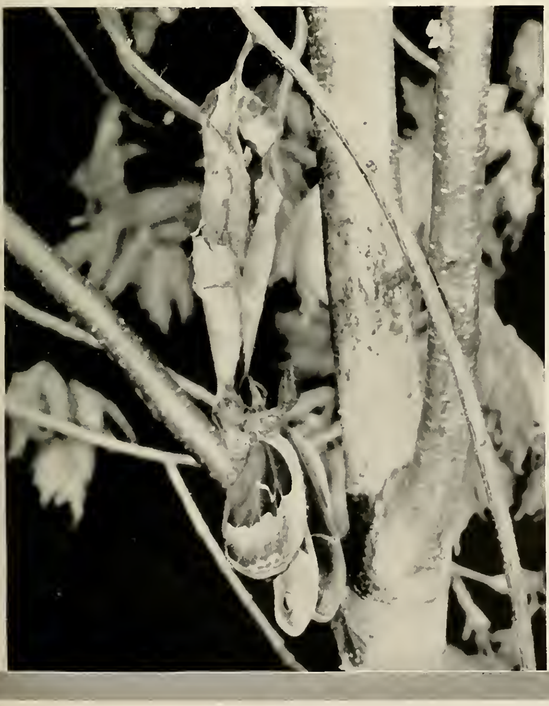




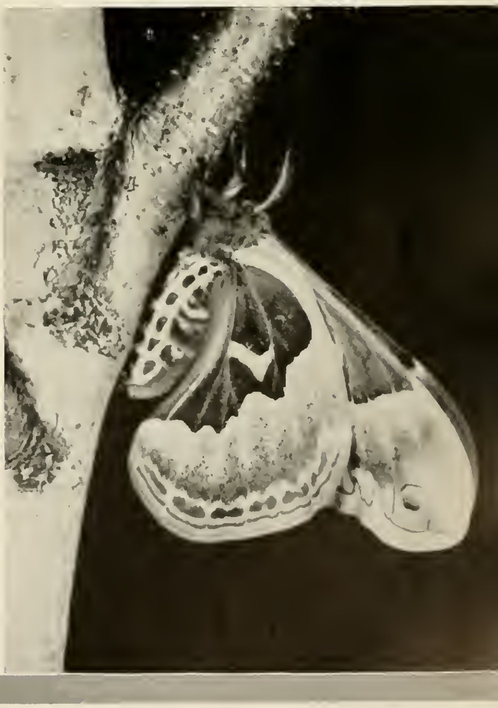
The pupa (Note discarded skin at bottom of cocoon)

Through the winter like dead leaves

and its wings grow big and strong



Promethea comes of age



ANTICOSTI

By WILLIAM MONYPENY NEWSOM

Two and one-half times the size of Rhode Island, Anticosti has remained a mystery to the public and a jynx to its long succession of private owners ever since Cartier discovered it in 1534

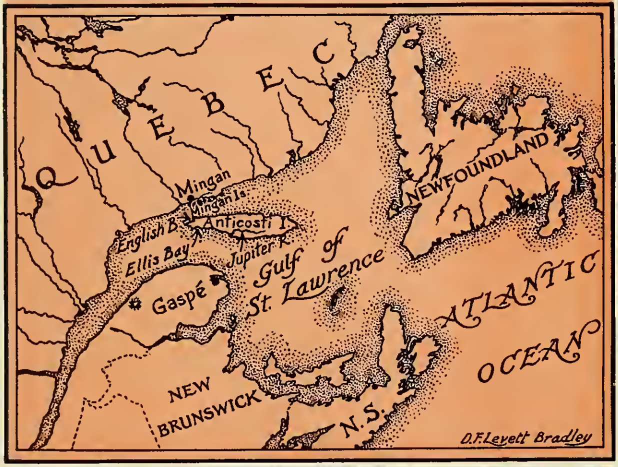


Photo by author

(Above) HIGHER THAN NIAGARA: the Vaureal River Falls. The scarcity of sound information on Anticosti's wildlife caused the author to visit the island for the American Museum

SCHOOL GEOGRAPHIES set forth the not very original information that an island is a body of land entirely surrounded by water. But in the case of Anticosti Island that description would be more vivid if it mentioned that this particular island always has been surrounded by shipwreck, disaster, bad luck, and misinformation, as well as water that is usually rough. At any rate, my first view of Anticosti was in this same geography. I was intrigued by it, as it seemed to me to resemble a colossal whale lying in the mouth of the Gulf of St. Lawrence, headed out toward Newfoundland, 150 miles away. But the geography's only comment was that it is 140 miles long, 35 miles wide, in latitude 49°-50° north, and in the island are to be found many bears. It was the latter comment that interested me most, of course, but it was years before I pieced together its history and went there to seek a personal interview with the bears.

It is well known that Jacques Cartier was credited with its original discovery in 1534 when he named it Ile d'Assumption, but even the famous Jacques could not make the name stick. Where the name Anticosti comes from is still a disputed point. Some think it was called Antecosta—"before the coast"—by early Basque fishermen. There are others who insist the name has an Indian derivation—"the place where you hunt bears." As to that, no one really knows.

During the century and a half after Cartier's visit, Anticosti has little history to record. It was, no doubt, visited by the Montagnais Indians from the North Shore, 21 miles away, who came there hunting bears or marten. This was a much easier crossing than the

45-mile run from the Gaspé on the south, and the North Shore Indians used it quite extensively. Then, in 1680, Louis XIV of France granted the island as a *seigneurie* to Louis Jolliet, who had explored the Hudson's Bay country and who, with Père Marquette, had also explored the Mississippi River. Since 1680 the island has always been privately owned.

For ten years Jolliet did a thriving business trading with the Indians of the North Shore. He wintered at Anticosti twice. Then, Frontenac, the French governor at Quebec, who had been making a number of raids on the English settlements, became such a nuisance that Sir William Phipps decided to attack Quebec. Setting out from Boston with a fleet of 35 warships and 2000 men, Sir William stopped along the way to burn a few French settlements—and stopped at Anticosti. Unfortunately for Jolliet, his little settlement, probably at Ellis Bay on the west end of the island, was a mark for Sir William's vengeance, as he completely demolished it. A bit later Sir William encountered Jolliet himself, and being well known to Sir William, Jolliet and his wife and family were taken along as prisoners. However, Sir William's luck did not hold long after he touched Anticosti, for at the mouth of the St. Lawrence he encountered a hurricane that dispersed his entire fleet. By a bit of poetic justice, one of the frigates with 67 men in the crew was wrecked on Anticosti. During the winter that followed the crew had a very bad time of it, and a number of the men died from lack of equipment and poor food. In the spring, a small boat was sent south to secure help. After an arduous 44-day journey it reached Boston. Finally, the relief ship arrived, but only 22 men out of 67 who landed in Anticosti lived through this adventure to reach Boston.

Jolliet, however, was later released and returned to the island, but seems to have lost heart and done nothing further about it. He died in 1700, but as far as I have been able to learn, no one knows exactly what happened to him or where he is buried, though it may be on one of the Mingan Islands, or perhaps on Anticosti itself. After his death his several heirs also entirely lost interest in it. These heirs sold out a few years later to parties who had various schemes to colonize the island. There is no record of exactly why the colonies failed, as they most certainly did, but one list of supplies sent to the colonists gives us a clue. This list included six quarts of violin strings, a large number of coffin handles, harness buckles, iron boot heels, carriage steps, English saddles, and a printing outfit. This, I suppose, came under the head of winter supplies, though it is not specifically mentioned.

In 1874 the Forsyth Company was formed to make another attempt to colonize the island. Colonists from Newfoundland were landed, but they fared no better than the others before them. This time the Canadian Government came forward to rescue the colonists to save them from starvation. Then about 1884, an optimist named T. W. Stockwell bought the island—which is two and one-half times as large as Rhode Island—at sheriff's sale, and turned it over to a speculative outfit known as "The Governor and Company of the Island of Anticosti." More bad luck. They promptly went broke, and the trustees of this company sold the island in 1895 for $125,000 to Henri Menier of France.

When Menier arrived, it was a happy day for Anticosti, for he was one of the richest men in France, proprietor of Menier's Chocolate. He not only had very large ideas but plenty of resources to carry them out. First, he was a sportsman interested in shooting and fishing—but more particularly bear hunting and salmon fishing—and he proposed to make this island a huge game preserve. He also had ideas of developing the island and its resources. So he arrived at English Bay (now Baie Ste. Claire), where there was a small settlement of fishermen and trappers on the west end of the island. He came in his 1000-ton steam barkentine yacht *Bachante* with 75 men in the crew and established headquarters here.

In 1898, however, Menier decided to move his headquarters to another harbor some nine or ten miles from English Bay. Accordingly he built Port Menier with its houses, church, school, stores and workshops, and connected the two villages with a good road. He cleared many hundred acres for farm land—which incidentally has never been productive,

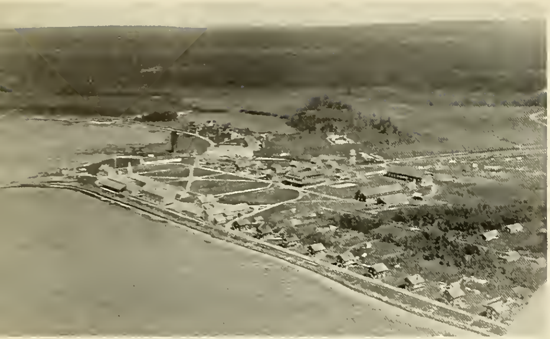


Photo courtesy of Consolidated Paper Corp., Ltd.

Port Menier. It was built in the days of high-priced pulp, but few of its houses are now occupied

Photo by author

A lighthouse on the North Shore cliffs: a peaceful view of a coast rich in the romance of history

as the soil is poor. And during this time he had his own freighter, the *Savoy,* with 18 men in the crew, running from Anticosti to Quebec for supplies. Menier spent the summers from June to September at Anticosti, living on the yacht a good part of the time—with telephone connection to shore.

About 1903 he started building the Villa, which was not finished until 1906. It is quite unique. The huge, imposing fireplace in the drawing room was designed by a French artist, while over it is a large Scandinavian wood carving of the sixteenth century. The black oak table and carved chairs to match are of Louis XIII period, and the four Flanders tapestries on the walls date from the sixteenth century. There is also a huge camel hair rug said to be of Arabic origin, and five water colors dated 1830 and signed by the French artist Gavarni. Around the top of the room are a dozen or so very dignified stag heads mounted in the European style. Here and there are other sporting trophies. In spite of this heterogeneous collection of treasures, the whole Villa was livable and attractive. Not the least interesting item in the Villa is the secret stairway. Only fifteen inches wide, it led from the rear of a clothes closet in Monsieur Menier's suite on the ground floor to a closet in the guest suite upstairs. None of his old retainers who knew him for years either could or would tell me who it was who occupied that upstairs suite.

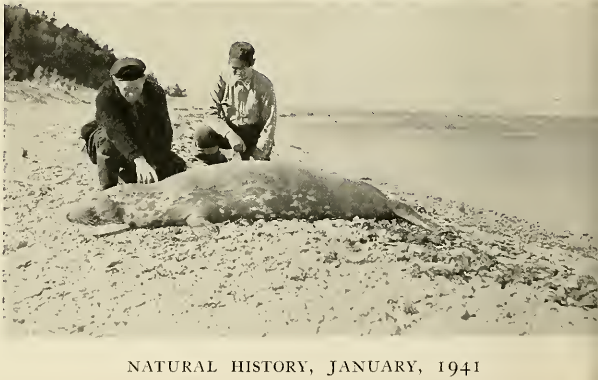
From all of this it is evident that Henri Menier was a lavish spender. But his spending had a practical side to it that is not apparent in his villas and his yachts. He wanted to develop Anticosti commercially, not only to help the 250 inhabitants but to make the island pay for itself. It was for this reason he had the land cleared for farming. Also he decided to raise cattle and other livestock. Both ventures failed. Menier blamed the failure of the cattle on the dogs of the island, which he said had worms. Accordingly, in 1900, he had every dog on the island either destroyed or deported—so there are no dogs there now. But still, for some strange reason, neither cattle nor sheep will thrive on the island, although pigs do well enough. While he was struggling with the farming, he built a dozen miles of railroad to take out pulpwood. But here again he was not too successful. Because he feared that forest fires would destroy the pulpwood, he would let no one on the island smoke or carry matches, strangers were strictly forbidden to land there, and those who had permits were always searched for matches.

As to Henri Menier himself, there are conflicting accounts. But his old foreman, Tancrede Girard, and

Landing the seal on a typical St. Lawrence beach

Gray seals sometimes attain nine feet in length

Photos by author



Hunting for seal. Note long gaff needed to retrieve the sunken animal after it has been shot

Photos by author

Hauling the rare gray seal aboard. These seals often weigh 600 pounds or more

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his personal guide and game warden, Bernard Le Jeunne, who were with him for 30 years or more, both agree. They tell me he was determined, resourceful, democratic, but inclined to fits of anger, not to say unreasonable rage. When some little thing displeased him, he would burst into a torrent of language, calling them all "animals." Yet while he was severe with the individuals, he considered all the inhabitants as his children and he was most generous in looking after their welfare. One of his most drastic rules was one prohibiting anyone from molesting game, and it went hard with those who were found poaching.

When Menier bought the island, intending to make it a game preserve, there were bears and foxes but no deer or other big game. Menier then stocked the island with deer, buffalo, wapiti and moose. The buffalo soon died and the elk did not thrive, there being but three or four old cows on the island today. Moose are present but not plentiful. The deer, however, multiplied beyond all expectations. Menier enjoyed shooting these, along with ducks, gulls, cormorants, bears and seals. He also was a keen salmon fisherman, but his greatest interest was in bear hunting.

I had, of course, heard of Menier's enthusiasm for hunting bear. At one time he had eight ordinary hounds and two big rough-coated staghounds on the island. I had also heard the rumor that he had a rocking chair mounted on a flatcar and he would cruise up and down the few miles of track, shooting bear from the rocking chair. As the story intrigued me, I decided to ask Bernard Le Jeunne, his chief guide for bear.

Bernard is old now, and his hair is white. His little eyes twinkle in friendly fashion, and one small drink starts a most abundant flow of conversation, all of it with appropriate gestures. Bernard's father was a hunter and fisherman of Scotch parentage who was born in New Brunswick. While Bernard speaks very broken English, he insists on calling himself Barney Young, although everyone else calls him Bernard Le Jeunne. So one evening when we were discussing the earlier days of the island I asked Bernard: "Is it true, Barney, that Monsieur Menier had a rocking chair on a flatcar and that he used to sit in the rocking chair and shoot bears from it?"

Instantly Bernard was on the defensive at the insult to Menier. He stiffened in his chair, then arose and held his right hand aloft.

"Ah, Monsieur," he said solemnly, "I hold up my hand and I swear to you that is the great libel. It is *not* true, Monsieur—he would nevaire do such. I

Sportsman's lean-to back in the game country

Anticosti still has bears. *(Below)* Flensing bear hide

Photos by author

deny, Monsieur, that the rocking chair was on the flatcar. Non. The rocking chair she was out on the long point of land where we have the bait put out for the bear. It was there, Monsieur Menier shoots at the bear—not from the flatcar at all.

"But did you get the bear?" I asked innocently.

"Ah, as to that—it was quite an evening, Monsieur. You see, Monsieur Menier he have a very old bulldog name Jack he have a long time and he love him. But Jack he have no teeth and cannot walk far. So Monsieur Menier have me put Jack in the basket and carry him and we go to the bait for bear. Then Monsieur Menier put the basket down by him in the rocking chair.

" 'Barney,' he say, little whispering, 'it is, I think, better Jack die hunting the bear.'

"Just then I feel something at my back. 'Monsieur Menier,' I whisper, 'there is the bear at my back.'

" 'Don't stir,' Monsieur Menier he say to me.

" 'But, Monsieur, she is biting my back,' I say.

" 'Don't stir, Barney,' say Monsieur Menier. 'You will disturb the bear.'

"Then the old bulldog she smell the bear and she come to life. He bark. He jump this way. He jump that way. In fact, Monsieur, old Jack she just raise the hell. And then Monsieur Menier he see the bear and he raise up out of the rocking chair and—what you think?"

"What?" said I breathlessly, expecting the bear to fall dead upon me. "Did he shoot the bear?"

"No, Monsieur," said Bernard sadly. "The dog she bark again and the bear she run away."

So much for that rocking chair.

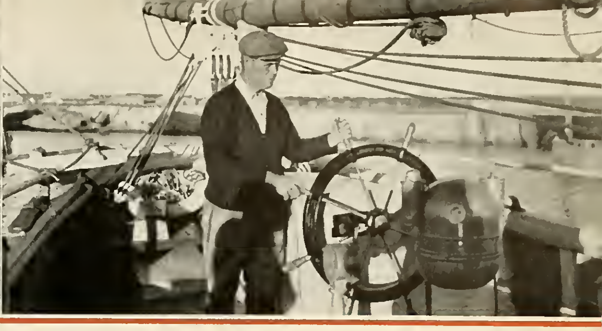
Bernard, with nearly all the other inhabitants, except the lighthouse keepers, was on Menier's pay roll by the year. But there was one man on the island who was not on the pay roll and Menier could not get rid of him. He was a squatter named McDonald, who had a cabin on the beach when Menier bought the property, at what is now called McDonald River, halfway down the north side of the island. McDonald was said to be a huge man six feet six inches tall, weighing 240 pounds, who lived alone and refused all company. For many years he lived there. Then one winter they found him dead. He had been dead a month before he was found, and the mice had eaten his nose. His diary showed he had taken some sable skins. These were never found, and to this day people are still speculating as to what happened to that valuable fur.

In 1913 or 1914, Henri Menier died, and left the island to his brother, Senator Gaston Menier. According to all accounts, Gaston was never as much interested in the island as Henri had been, and he spent only a month each year there. He still kept it as a game preserve until he sold it to the Anticosti Corporation for the equivalent of six million dollars. Gaston, however, reserved the salmon fishing rights on the Jupiter River for himself for ten years. When he left the island, he gave each of the old retainers a sum of money ranging from $100 or $200 to $1000. Girard, who held a responsible position, told me that he himself received $1000 and that about 20 men received a bonus.

For several years after the Corporation took over the island it tried in vain to break Anticosti's hoodoo. Pulp operations started on a huge scale. Port Menier's population increased to over 4000 inhabitants, and hundreds of thousands of dollars were squandered on loading docks, machinery and equipment. But in the end, the old jynx of Anticosti won out, pulp operations ceased, and the company merged into the Consolidated Paper Corporation, Ltd., the present owners. Realizing the pulp situation is hopeless, the new owners set about developing other assets, such as fox farming and salmon fishing for sportsmen.

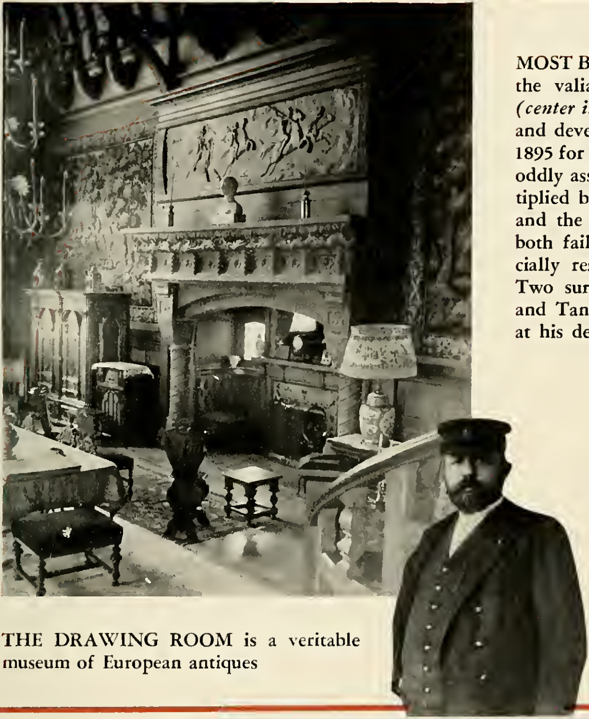
So many salmon fishermen have been to Anticosti that I thought, when I planned a trip there for the American Museum, that there would be no trouble to learn from them all about the mammal life to be found there. But here again the mystery surrounding this island was apparent. The Museum had no specimens from Anticosti, except two old, black bear skulls that came by way of the Bronx Zoo. There was no reference to Anticosti in the Museum Library, and the salmon fishermen either had no information or told me fairy tales of seeing little red squirrels, when actually no squirrel of any kind has ever been known on Anticosti. Then one, who claimed to be an "authority" on all things Anticostian, told me the deer are very small, and that a "good buck would weigh 90 or 100 pounds live weight." Actually, the deer of Anticosti are normal size—the first buck I took weighing 240 pounds. Also in this strange tangle of tales I found a record of a new variety of marten with white-tipped feet, as well as several records of a new bear that had never been described—both of these stories turned out to be pure myths. I was also told we would find along the coast the ordinary small harbor seal. We found, in addition, the comparatively rare gray seal, locally called the "horsehead," that attains a length of nine feet and weighs upward of 600 pounds. So, little by little the mystery island, closed for so long by Menier, is giving up its secrets.

As to its future, it is anyone's guess what the price of pulp will do for it. Eventually Anticosti will probably go into the hands of the Canadian Government where it should be, commanding as it does the gateway to all of Canada via the St. Lawrence River. But, in the meanwhile, it is the salmon fisherman's paradise.



Photos by author

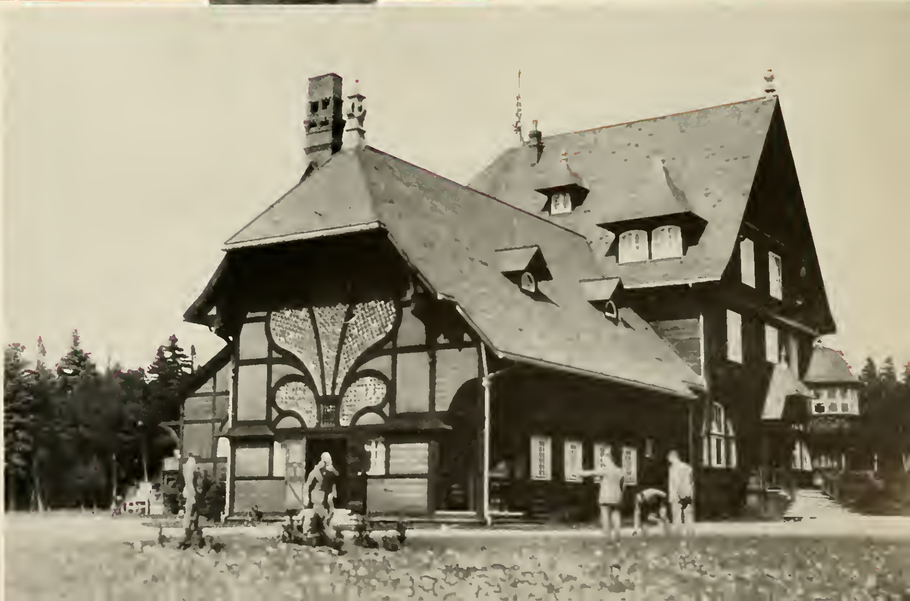
MOST BIZARRE chapter in Anticosti's unique history was the valiant attempt of Chocolate King Henri Menier *(center inset)* to turn it into a vast, private game preserve and develop its resources. He bought the large island in 1895 for $125,000, pouring several times that sum into such oddly assorted imports as buffalo herds, deer, which multiplied beyond all expectations, twelve miles of railroad, and the Villa shown below. Farming and cattle-raising both failed. Though crotchety at times, Menier was socially responsible, and the inhabitants loved him well. Two surviving retainers, Bernard Le Jeunne *(top left)* and Tancrede Giraud *(top right)* both received bonuses at his death



THE DRAWING ROOM is a veritable museum of European antiques

(Below) MENIER'S VILLA reflected the traditional eccentricities of a feudal-minded millionaire, even to the point of a secret stairway. Menier lived here only in summer

Photos courtesy of Consolidated Paper Corp., Ltd.



GEM FOR JANUARY

The mystic radiance of your birthstone, the blood-red garnet, symbolizes all the power and charm which the ancients attributed to it

The First of a Series *By* FREDERICK H. POUGH

Assistant Curator, Geology and Mineralogy, The American Museum of Natural History

BRITISH soldiers fighting the rebellious Hanzas of India in 1892 can testify to the literal bad luck of garnets. Ill omen, often associated with gems in legend, in this case accompanied garnets worn unwillingly and internally, for the superstitious Hanzas fired at the soldiers, using garnets as bullets. But garnets usually are regarded as stones of good omen, bringing calm and removing anger and discord when worn as charms. Other legends attribute healing powers to them, though this myth can scarcely have led to their use as missiles.

The concept of natal stones is an old one, having its roots in ancient times, perhaps even before recorded history. The breastplate of the high priest mentioned in the Old Testament contained twelve stones which were related to the zodiacal signs and to the months. Originally it was thought that the wearing of a different stone each month assured good fortune. Later, possibly in the early eighteenth century in Poland, the idea was developed of a natal stone to be worn by each person according to his birth month, with the purpose of bringing him good fortune. Today's birthstones are a modification of the stones of the breastplate, interpreted to the best of our ability from the scanty description extant, from our knowledge of the geology of the Mediterranean region, and from the gems we find in excavations. In 1912, the National Association of Jewelers adopted an official list, which is today generally accepted, giving the birthstones and some alternates for each month of the year.

Garnet is the stone for January. The gem which the jeweler recognizes is only the deep red of the almandine or the pyrope garnet. While the mineralogist recognizes many other gems as members of this large group—the rich brown of the essonite, the violet of rhodolite, and the brilliant green of the demantoid—the jeweler justifiably does not include these as January birthstones. Justifiably because the ancients depended upon color for their classification, including ruby, spinel, and garnet under the general term, carbuncle. We thus have almost complete latitude in our choice. In fact, we may consider any of the garnet group as our birthstone, if we do not like the rich, deep reds of the pyrope.

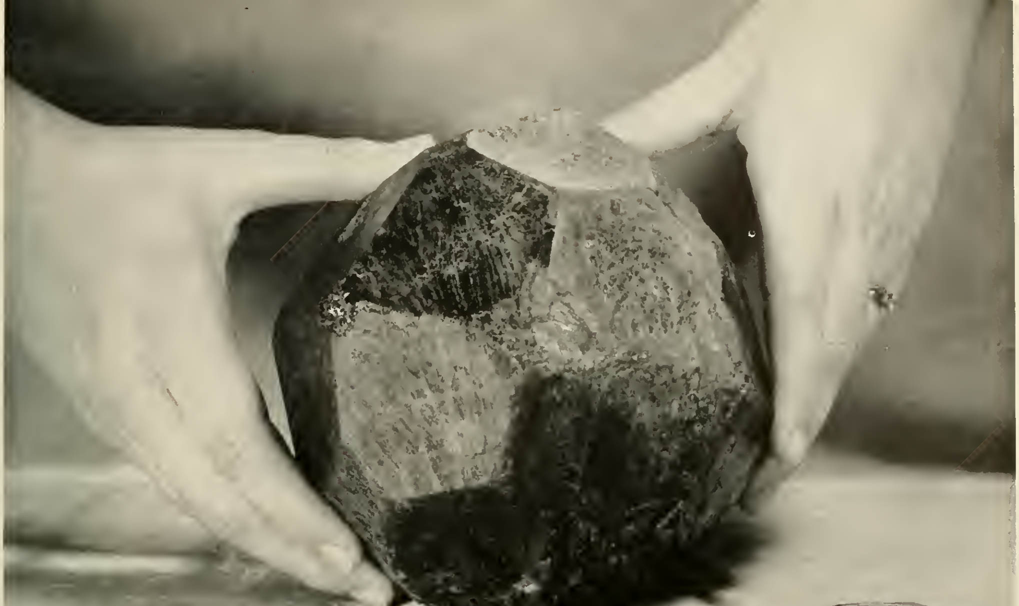
Garnets are among the commonest gems. They form, mineralogically, a large group of silicate minerals—some with calcium and aluminum; some with manganese, magnesium or iron, and aluminum; calcium and iron; calcium, magnesium, and iron; or calcium and chromium. They are hard, have attractive colors, and are often in clear, twelve-faced crystals, eminently suitable for gem use. Consequently, we find them extensively used. Bohemian jewelry, with its pavements of pyropes, displays some of the best known garnet work. The Bohemian stones are found as loose, waterworn pebbles in layers where they have been concentrated after washing out of a bed of basaltic rock. Garnets are often found in the United States. Anthills in the Southwest yield small garnet pebbles which are "mined" by the ants and dumped on the surface out of the way of their tunnels. A light violet variety is sometimes found in North Carolina and is known as rhodolite; if it were more abundant it would be a popular gem.

Garnets are frequently cut in faceted shapes, but they are generally so dark that a trick is necessary to give them any fire. Such stones are cut in a convex form, known as cabochon, with the bottom slightly hollowed out to make less thickness and greater transparency. Engravings on large garnets are frequent, and beautiful examples are sometimes seen. The collection of the American Museum includes, among other pieces, a small bowl cut from a garnet.

Cabochon-cut garnets are known today as carbuncles, an ancient name derived from the Latin *carbo,* coal, and referring to the internal fire-like color and reflections of garnets. But the ancients could not differentiate among the red stones; and today we find it difficult to be sure exactly which gem was meant in some of the old legends in which the stone was called simply carbuncle.

Innumerable legends are associated with the garnet, many of them referring to a fancied luminescence. The Talmud relates that Noah's Ark was illuminated by the light of a single large cabochon. Many other stories associate it with snakes and serpents. Possibly the redness of the eye or mouth fostered the tale that the reptiles carry a light in the forehead or mouth. When the snake occasionally dropped the stone to look at it, an intrepid warrior could dash up and cover the stone with mud or a cloak; whereupon the poor animal, no longer able to find it, would finally wander away to die of grief or commit suicide. The association of carbuncles and serpents is a legend which repeatedly crops up in apparently unrelated places. Even our Cherokee Indians have a tale of a snake carrying a luminous carbuncle in its forehead. This "light" was stolen by a warrior and displayed on special occasions, being accorded great religious awe.

Garnets possess other mystic qualities, often seemingly at variance with one another. The blood-red color has been thought to be symbolic of Christ's sacrifice. The Koran's fourth heaven is built of carbuncle. An Arabian dream book says that any monarch who saw a garnet in his sleep would have great joy and good fortune, and would be more feared by his enemies than before. Today a garnet is still supposed by the credulous to preserve some of its ancient efficacy, from the day when it was supposed to give or preserve health, keep off the plague, reconcile differences between friends, increase riches and honors, to serve as an emblem of constancy, and, when worn around the neck, to keep off thunder.

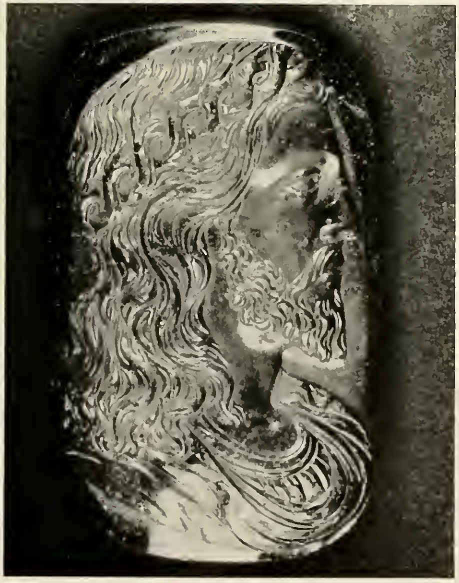


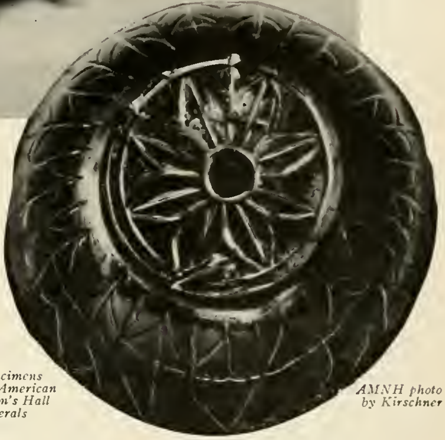
THIS massive ten-pound garnet enjoys none of the traditional romance associated with historic gems, but it boasts the unique distinction of having been found within a stone's throw of Macy's Department Store, in the heart of New York City. Though usually red, garnets are also rich brown, violet, and brilliant green.

(From N. Y. Mineralogical Club Collection)

(Below) A beautifully engraved garnet, originally in the Vatican Collection

AMNH photos by Coles



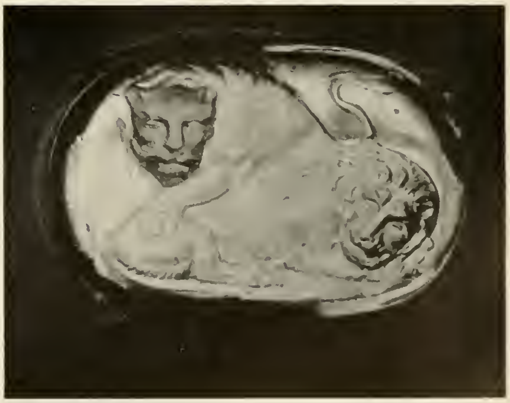


All specimens in the American Museum's Hall of Minerals

AMNH photo by Kirschner

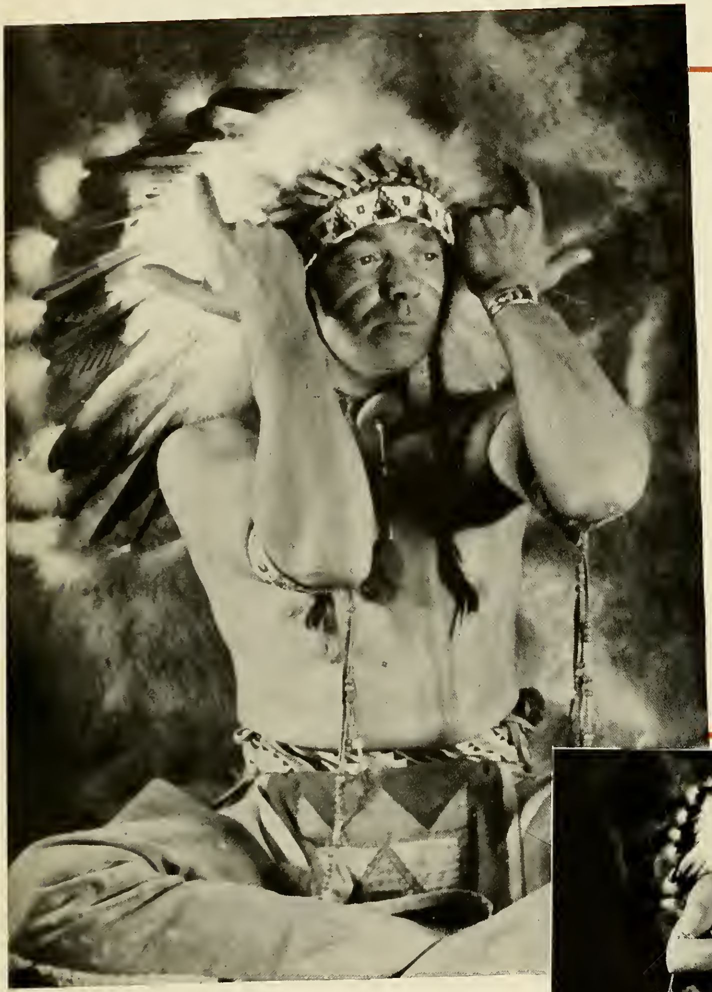
(Above) An old Hindu bowl of garnet

(Below) TWO LIONS. Concave cameo from Burma



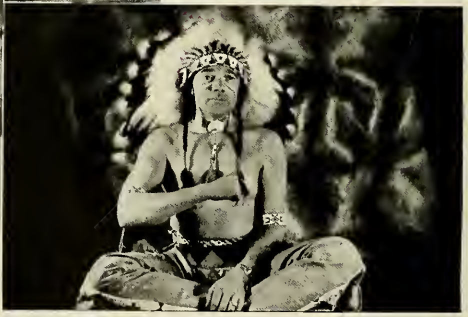
TALK-WITHOUT-TALK

By ROBERT HOFSINDE
(Gray-Wolf)
All pictures posed by the author

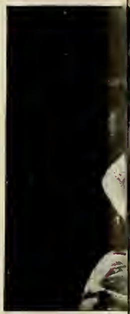


The picturesque clarity of the American Indian's sign language is shown by the gesture-word for "buffalo" *(at left),* the animal which, more than any other force in the life of the Indians, necessitated the development of the universal language of the Plains. The extended thumbs, representing the ears, wiggle; and the forefingers, indicating the horns, may be omitted entirely to symbolize a calf

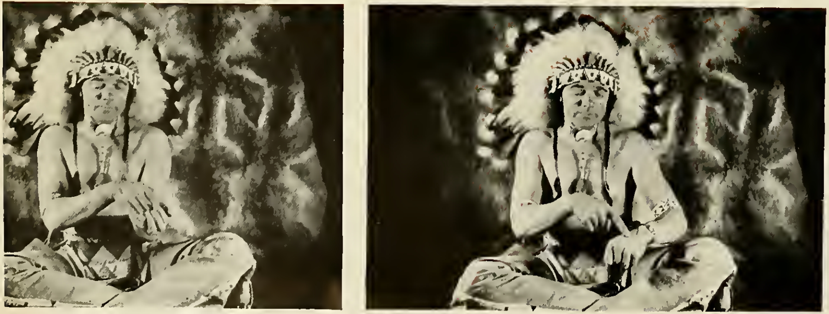
Below are shown a series of signs illustrating how the various parts of speech can be represented in the sign language



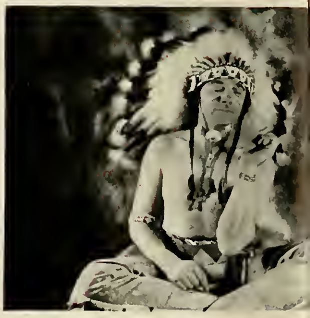
PRONOUN: "I" Expressed by the simple gesture of touching the thumb to the chest



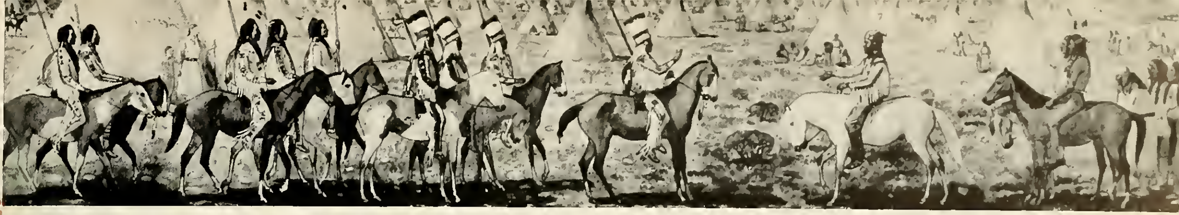
ADJECTIVE



NOUN: "OJIBWAY" Two signs are needed to express this proper noun. The first shows a soft, puckered moccasin; the second, with a rubbing motion, denotes red skin



ADVERB: "TIMIDLY" The rai
"man,"
like a



From a mural in the American Museum by the well-known Indian artist, E. W. Deming

THE INDIAN'S GREATEST INVENTION

THE American Indian's greatest invention was the sign language. By a system of several hundred signs, representing all the parts of speech, the Indians of the Plains conversed together with a flow of motions which equaled the articulatory dignity of spoken speech. Nowhere else in the primitive world was such a system of talk-without-talk even approached.

The old Indians laugh when they tell the story of how an early white man observed Indians using the sign language and thought that they were childlike persons incapable of full, normal speech. Actually the white man was witnessing the most marvelous gesture-development found in any continent, a method of communication comparable to the invention of the Chinese ideographs of the Orient. Further than that, the Indians were using what was to them virtually a universal language—the potential value of which we can easily see in our modern polyglot world.

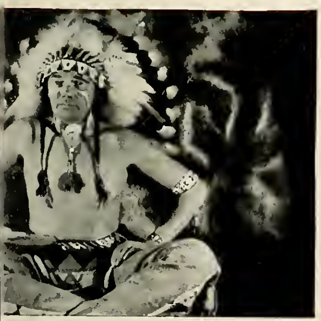
When the Indians of the Plains hunted the bison over a large area, fifteen or 20 tribes speaking different languages were brought into contact with one another. Unable to converse in any other way, they developed the use of signs, and in time perfected this marvelous language. The American Indian sign language attained a vocabulary and complexity at least 20 times as great, and by some standards 100 times as great, as any other comparable system elsewhere in the primitive world.

All who have studied the sign language of the Indians have marveled at the eloquence and strength with which its few hundred signs can express almost any message that the speaker wishes to convey. The American Indian sign language has given romance to the study of the American Indian. It has also thrown light on the grammar and fundamental concepts of the Indians' spoken word. More than this, the sign language has been one of the features of the American Indian's life well adapted to being taken over into our white civilization, the silent sign serving many purposes in the modern world. The Boy Scout movement has taken up the sign language with eagerness; and its use as an adjunct to the hand-alphabet of the deaf and dumb has scarcely been explored. Probably no other phase of Indian culture has proved so interesting to the American public at large.

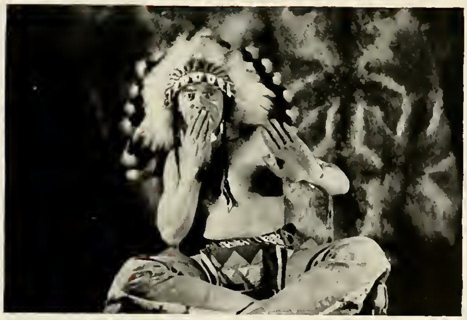
At present there are comparatively few Indians left who can talk sign language fluently. Those Indians so fortunate as to have learned the flow of signs from the generation which went before them are now aged survivors; and the time is near when the best speakers will be no more. There is a real need, therefore, to kindle a broader interest in the sign language and to preserve it for the future.

John P. Harrington

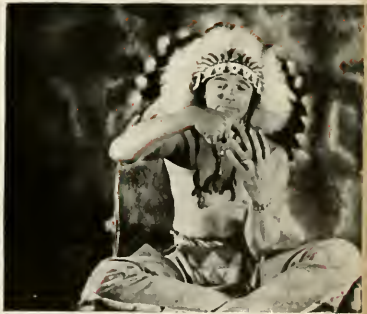
Bureau of American Ethnology,
Smithsonian Institution



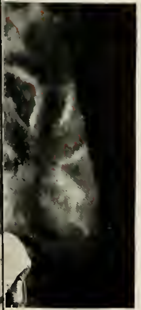
'HUNGRY" Motion like sawing body in two with edge of hand



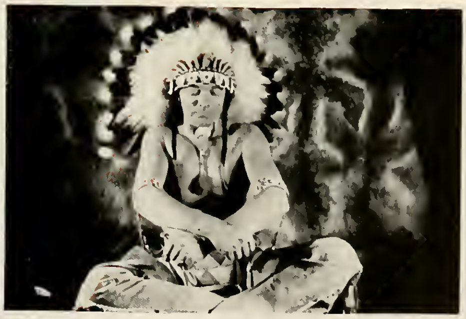
INTERJECTION: "ALAS" Means also surprise or joy with appropriate face



PREP: "AMONG" Weaving motion among fingers



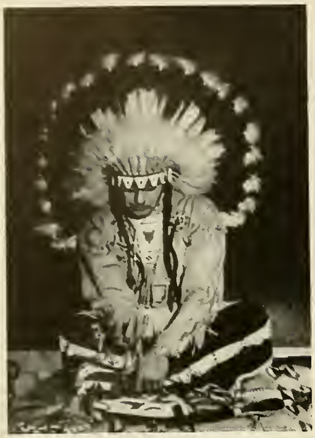
finger, denoting
alls backwards
ard



VERB: "CAPTURE" The posture of bondage signifies to capture or be taken prisoner

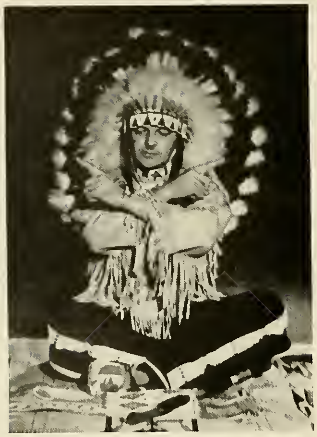
PUT THEM ALL TOGETHER AND YOU HAVE:

"I was so hungry, alas! that when I found myself among the Ojibway Indians I timidly allowed myself to be captured."

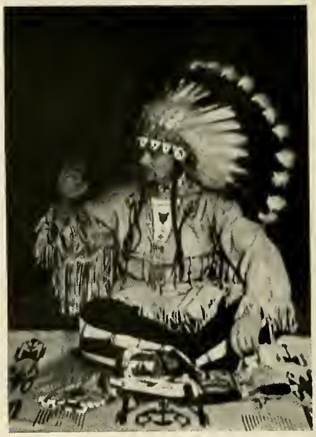


All photos by Melvin Martinson

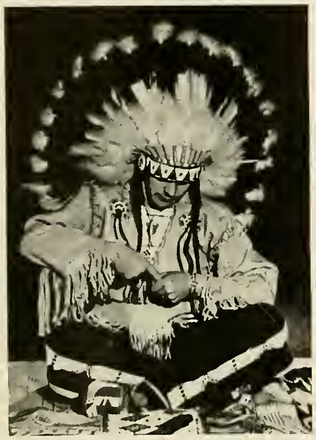
FIRE—Snap fingers up from thumb repeatedly, like leaping flames



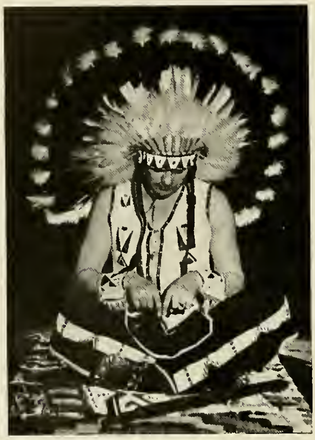
TRADE—From shoulder position, cross forearms, forefingers extended



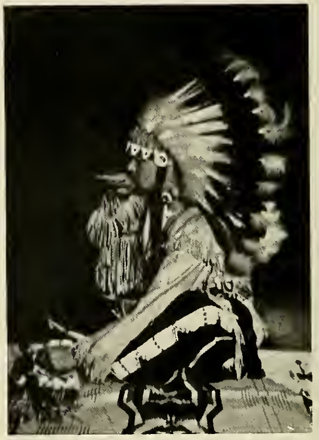
QUESTION—Rotate raised hand in a small circle by wrist action



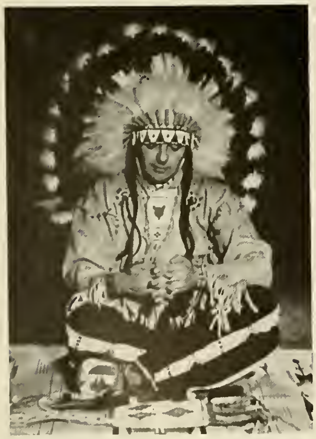
ARROW—Motion to shoulder imitating withdrawal of arrow from quiver



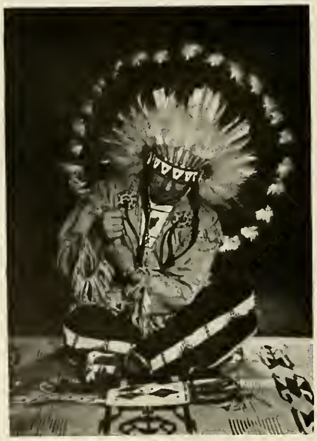
EQUAL—Forefingers move forward side by side, imitating an even race



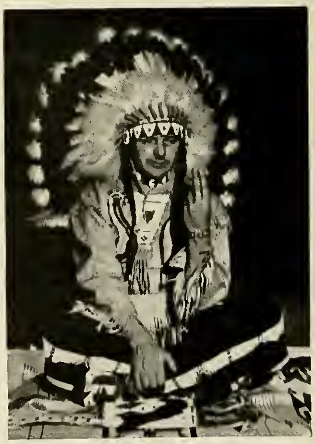
LIE—Two spread fingers show "double talk" or man with split tongue



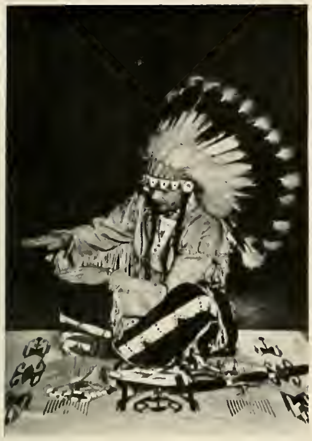
HOUSE—Like a log house. Cheyenne pointed fingers up like gabled roof



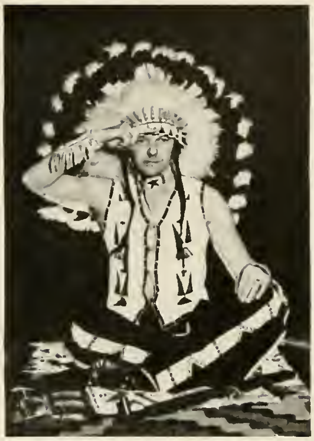
KEEP—Grasp moving left finger in right hand and hold firmly



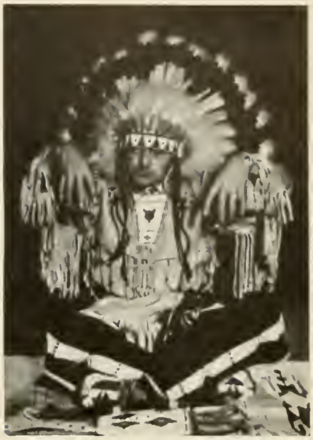
FRIEND—Forefingers together, meaning brothers growing up together



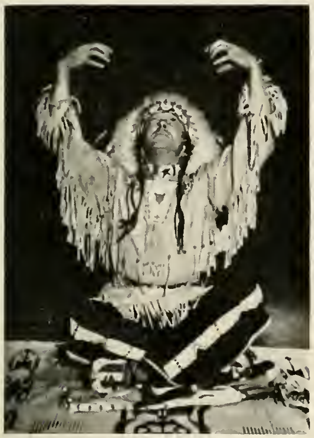
WALK—Move hands alternately forward, as if walking on hands



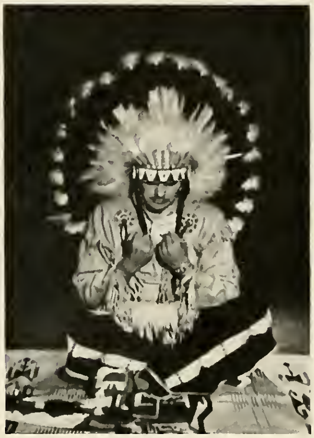
WHITE MAN—Indicate hat brim by drawing finger across forehead



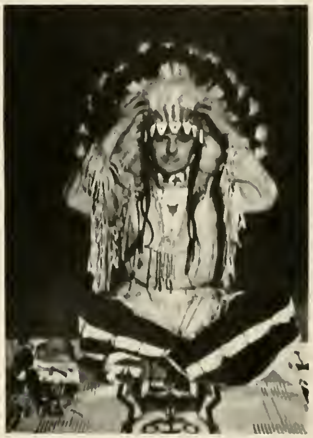
RAIN—Drop hands straight to waist
SNOW–Same swirling, like a blizzard



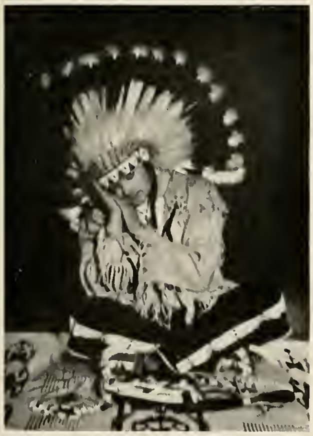
HOT—Hands sweep down and stop just short of head, like rays of sun



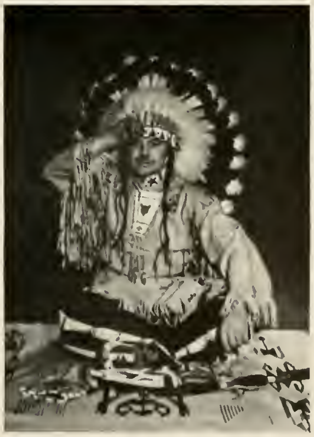
COLD—Fists are clenched as when cold, and brought against chest



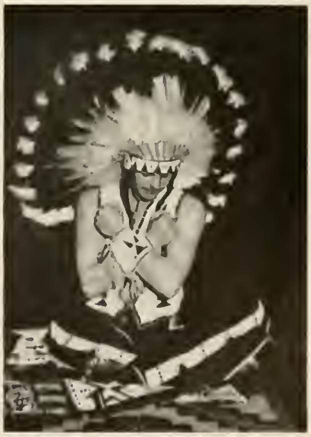
WOMAN—Like combing hair with fingers. This plus "little" means girl



SLEEP—A sign showing position of sleeping on ground, head on hands



CRAZY—Circular wrist action, not unlike "screwball" & "bats in belfry"



FOND—Crossed fists pressed to breast. Means also "love" and "like"

SIGN LANGUAGE IS SHORTER THAN ENGLISH

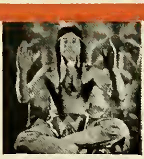
Over 1000 characters are necessary to tell this short story in English, whereas only 169 gestures are needed in the sign language. Read the English version first, then examine the Indian method of telling the story opposite.

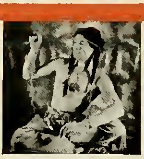
THE BOY WHO BECAME A CHIEF

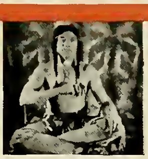
WHEN I was a little boy, I wanted to do big things for my tribe and be a great warrior.

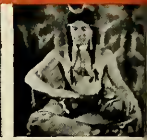
When at last I was grown, the Chief called me to his tepee and told me to go to the village of the Sioux, there to find out if they planned to fight us, or some other tribe.

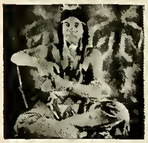
I was now a scout, and when night came I took a canoe and went up the river towards the Sioux camp. All night I went in the dark, and when morning came I made camp along the shore among the trees and stayed there all day.

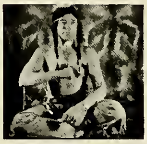

MANY
Hands dip and rise, almost touching

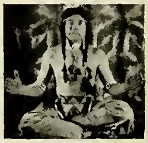

MOONS (ago),
Sign of quarter moon

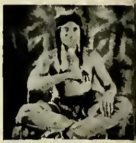

ME

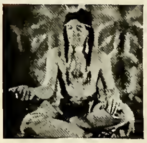

LITTLE

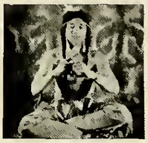

HORSE,

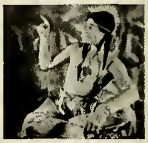

BE

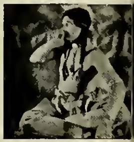

BIG

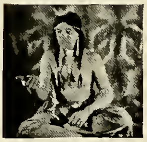

SCOUT.

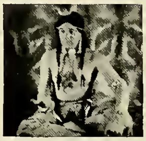

HIS

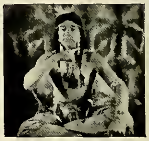

TEPEE.
Hands move down and apart

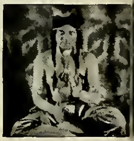

CHIEF
Motion for man above others

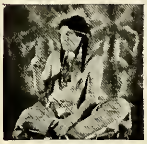

TELL
Flicking of forefin

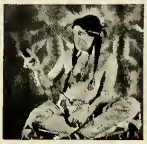

HE

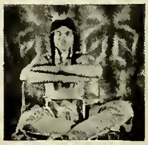

KNOW
Out from abdomen and back

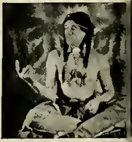

SIOUX
"Cutthroat"

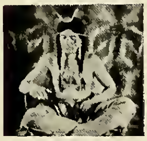

MAKE
Brush hands up and down

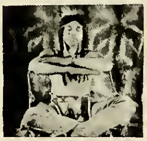

NOW
Hand flicks like marking an instant

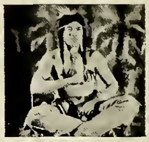

SCOUT.
"Wolf"

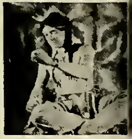

NIGHT
Like covering something over

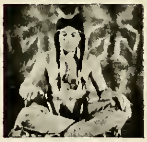

COME.
Motion toward speaker

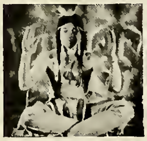

ALL
Hand moves in flat circle

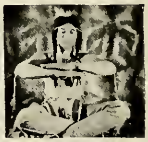

NIGHT
Like covering something over

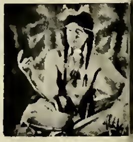

ME

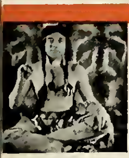

PADDLE.

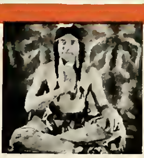

ALL
Hand moves in flat circle

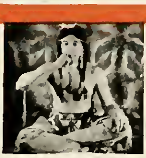

DAY.
Crossed arms uncover something

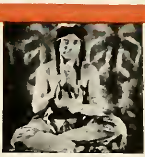

NIGHT
. . . . and cover it over again

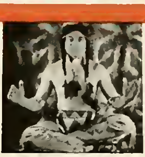

COME.
Motion toward speaker

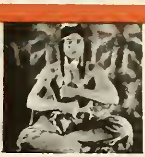

MAN.
Upright finger

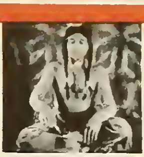

ME

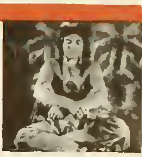

WANT
Several downward twists of wrist

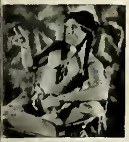

MAKE
Brush hands up and down

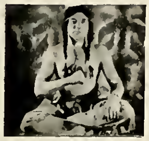

BIG

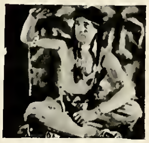

WAR,
Fists circle each other

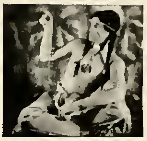

GO
Hand dips away

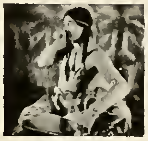

CAPTURE
Posture of bondage

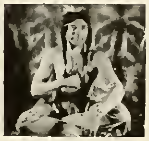

Me" plus "wolf"

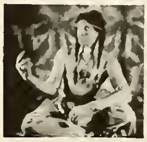

ME

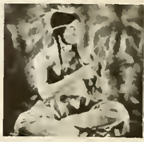

GROW UP.

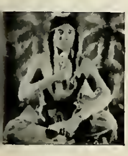

CHIEF
Motion for man above others

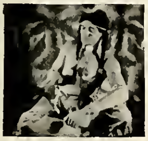

TELL
Flicking of fore-finger from thumb

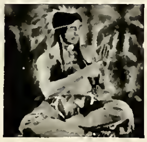

ME

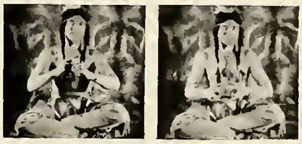

COME
Motion toward speaker

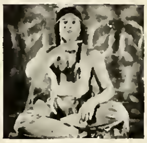

TO
Finger jabs palm

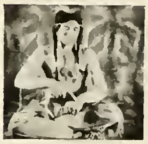

ME

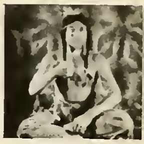

GO
Hand dips away

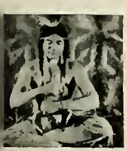

TO
Finger jabs palm

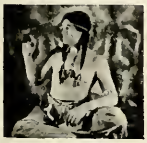

VILLAGE
"Tent cluster"

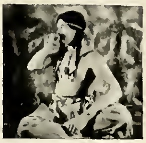

SIOUX
"Cutthroat"

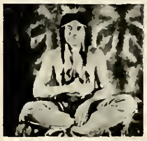

INDIAN
Circular rub denoting red skin

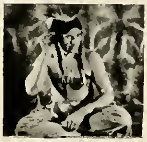

STAY.
Fist thumps air

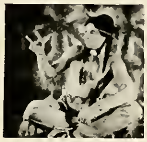

WAR.
Fists circle each other

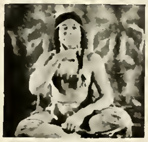

CHIEF
Motion for man above others

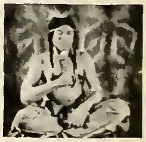

TELL
Flicking of forefinger

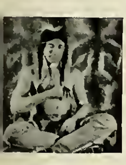

ME

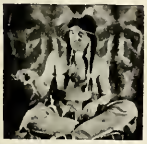

LISTEN,

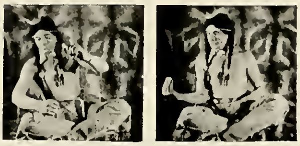

SCOUT
"Wolf"

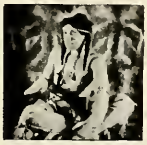

SIOUX.
"Cutthroats"

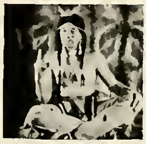

ME

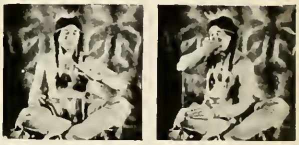

ME

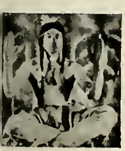

TAKE
Hooked forefinger toward body

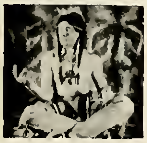

CANOE,
Paddle plus curved bow

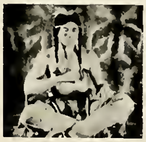

GO
Hand dips away

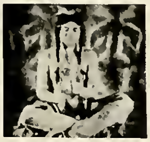

UP

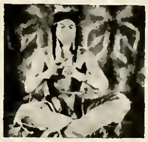

RIVER.
Wave-like motion *Drinking gesture*

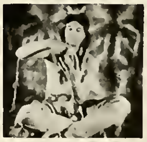

MORNING
everse of "night"

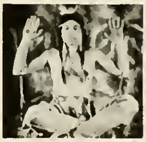

COME.
Motion toward speaker

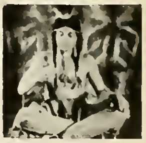

ME

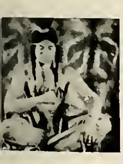

MAKE
Brush hands up and down

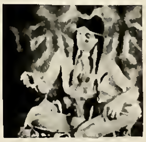

CAMP
Hands move down and apart

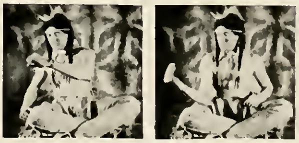

AMONG
Weaving motion

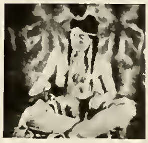

TREES.
Hands tremble like leaves

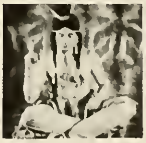

STAY
Fist thumps air

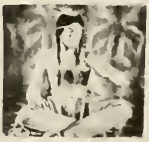

ME


TAKE
Hooked forefinger toward body


CANOE,
Paddle plus curved bow


GO
Hand dips away


UP


RIV—
Wave-like motion

Continued

THE BOY WHO BECAME A CHIEF

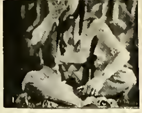
(Continued)

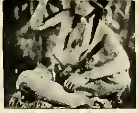
When night came again, I continued up the river, and when the moon was high I came upon the Sioux village.

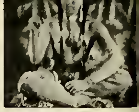
While I was listening to one of the old men talking, one of their scouts saw me and captured me. I was brought before the Chief, and he told me that I was to die in the morning.

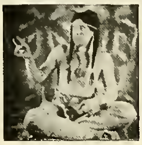
I was then taken to a smaller tepee and held captive there, but during the night I worked hard to escape, and finally got free. In order to get away, I had to kill the scout and steal his horse. I rode as fast as I could until I was at the river again, where I hid until nightfall. Then, on the rested horse I hurried back to my father's village and told the Chief all that I had seen and heard. The Chief was thankful and he made me a subchief.

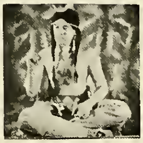
Continued from preceding page

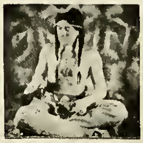

ER.
Drinking gesture

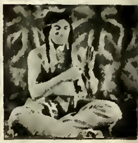

MOON
Sign of quarter moon

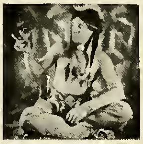

HIGH.
Directional motion toward zenith

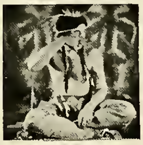

WOLF

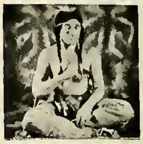

NOW.
Hand flicks like marking an instant

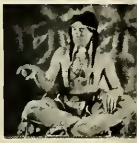

GO
Hand dips away

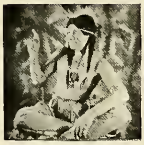

TO
Finger jabs palm

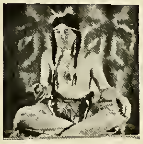

SCOUT
"Wolf"

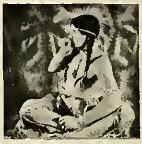

SEE
Sighting along two spread fingers

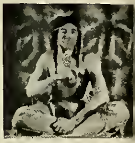

ME.

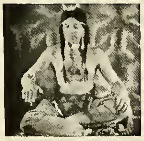

TAKE
Hooked forefinge toward body

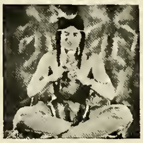

CHIEF.
Motion for man above others

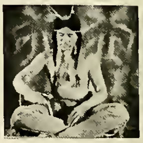

HE

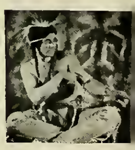

SAY
Forefinger flicks

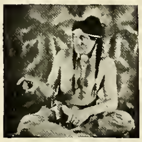

ME

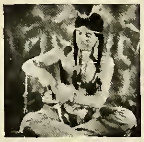

LITTLE

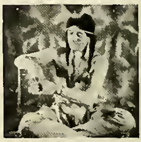

TEPEE.
Hands move down and apart

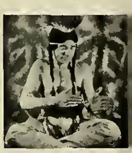

ALL
Hand moves in flat circle

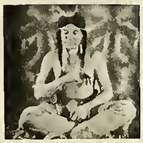

LONG
Like drawing a long bow

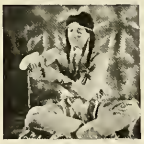

TAKE
Finger hooks toward body

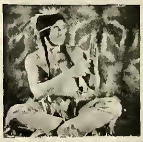

HORSE.

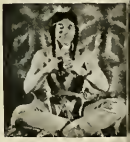

RIDE
Galloping motion

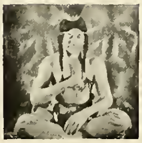

FAST
Hand brushes pas other hand

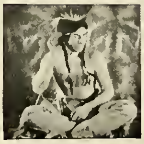

ME

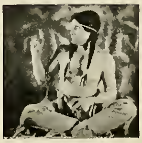

RIDE
Galloping motion

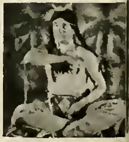

TO
Finger jabs palm

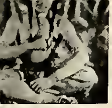

VIL
"Ten

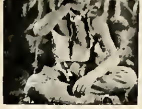

ME

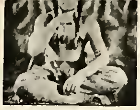

HEAR.

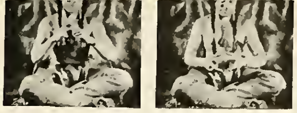

CHIEF
Man over others

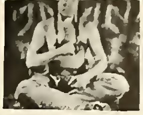

HEART
Shape of heart, in place


ME


SEE
Sighting along two spread fingers


SIOUX
"Cutthroats"


VILLAGE.
"Tent cluster"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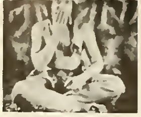
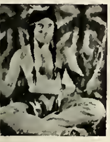
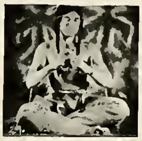
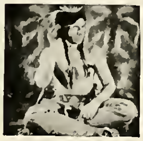
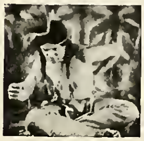
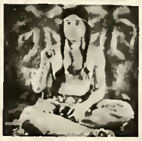

SILENT

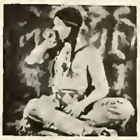

BIG

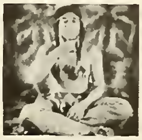

TEPEE.
Hands move down and apart

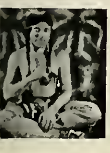

HEAR

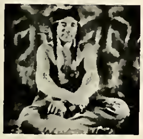

OLD
Aged person with stick

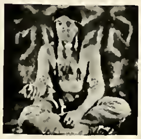

MAN

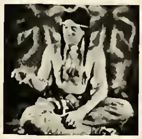

TALK.
Forefinger flicks

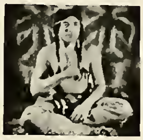

SIOUX
"Cutthroat"


ME


CAPTIVE.
Posture of bondage


HE


TAKE
Hooked forefinger toward body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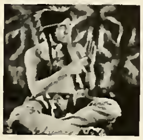
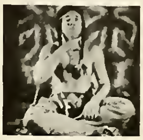
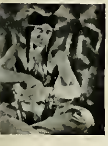
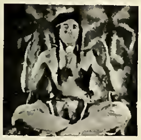
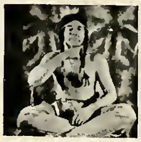

TO
Finger jabs palm


SIOUX
"Cutthroat"


DIE
or finger goes
er other hand


DAYBREAK.
Crossed arms uncover something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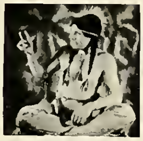
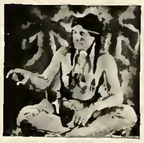
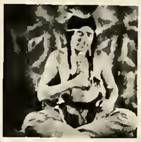
"Cutthroat"


SCOUT
"Wolf"


TAKE
Hooked forefinger toward body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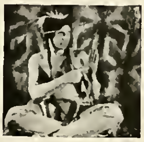
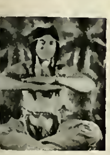
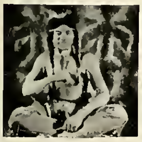

TO
Finger jabs palm


NIGHT
ike covering
mething over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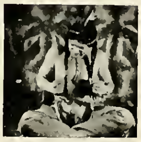
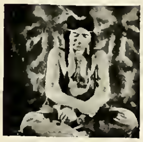
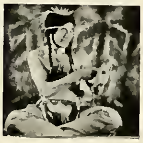
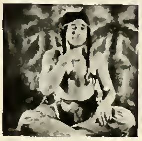
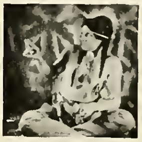
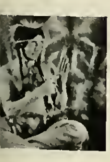

STRUGGLE.
Fists leave body with effort

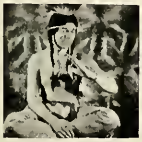

ESCAPE!
Bondage broken in upward motion

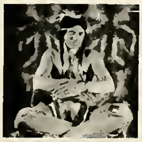

KILL
Finger cuts through spread fingers

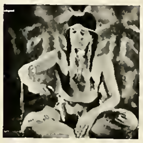

SIOUX
"Cutthroat"

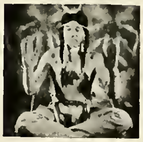

SCOUT.
"Wolf"

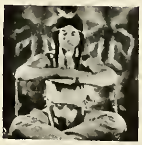

TO
ger jabs palm

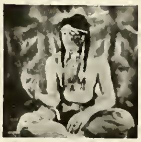

RIVER.
Wave-like motion

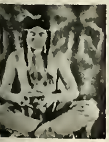

HIDE
One hand hides behind other

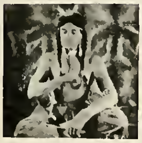

ALL
Hand moves in flat circle

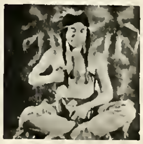

DAY.
Crossed arms uncover something

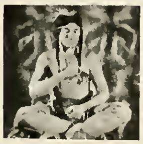

NIGHT
Arms return, like a lid


COME.
Motion toward speaker


GE
ster"


MY


FATHER
Fist touches right breast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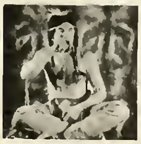
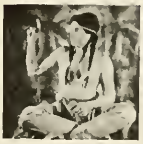
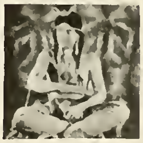
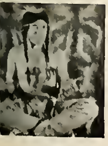
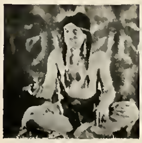
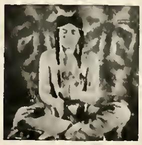

TELL
Flicking of forefinger

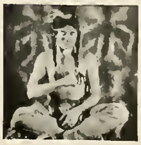

CHIEF
Man over others


ALL
Hand moves in flat circle


GLAD.
otion of being uplifted


HE


MAKE
Brush hands up and down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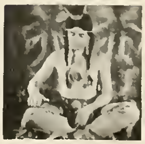
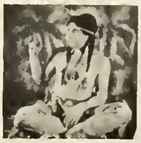

LITTLE


CHIEF.
Man over others

END

PARKY

The story of a young walrus who traveled farther south than his relatives in Bering Strait

By WOODBRIDGE WILLIAMS

PANIC! even his bellowing ceased, but his globular eyes betrayed the fear that this 150-pound baby felt while being hoisted through the air

AT HOME on the floating ice north of Bering Strait, Parky's herd indulged in the pleasant pastime of sleeping in the warmth of the Arctic sun, unaware of dangers

PARKY was no ordinary infant, in fact he was quite a singular creature. Already his sparsely-haired, thick, gray hide was furrowed and creased as if by age—quite a peculiar state for a baby only two weeks old. And his shape? Well, it was rather indefinite. He would at times suggest a little hippo that had sprouted flippers on the ends of his stubby legs instead of feet. But it would really be difficult to compare any other living animal, except perhaps the seal, with this good-natured, roly-poly infant walrus. His unique voice with its plaintive variations was something like that of a seal, but much more expressive.

At the moment Parky was not expressing himself audibly, as he was quite contented. He lay in the warmth of the Arctic sun on a glistening ice pan. All about him the dingy gray mounds of the sleeping walrus herd were sprawled and piled upon one another in wild confusion. He felt secure among these dormant heaps of quiet power, especially because surrounding him were the bulky bodies of his parents, which roughly circumscribed the small area in which he rested. When approached by danger, his mother, by pushing him in front of her with her massive chest and guiding him with her fore-flippers, would propel her offspring toward the sea and safety.

Parky's parents meant more to him than safety. He found fine sport swimming and playing with them in the sea. There he felt more at home than slithering about on the slippery ice. He and his elders would dive and leap in a way that suggested the antics of dolphins.

Perhaps Parky's major interest in life was food. He was about a 150-pound baby; such an infant requires an abundant food supply. Quite often he would retire to his mother to indulge in his favorite pastime of feeding, and in this he acted like any young dog or pig or calf, for he was just as much a mammal as any of them. His mother, in order to feed such a large, ravenous youngster, required a great deal of nourishment herself. Her diet consisted principally of clams, for which all her seemingly peculiar and useless structures were very well adapted. With her tusks, she dislodged the mollusks from the ocean bottom; with her large flattened teeth, she perhaps crushed the shells before swallowing. Her thick coat of blubber beneath a tough hide protected her from the cold of the depths. Powerful muscles enabled her to descend to the walrus meal table, which in Parky's locality was 180 feet beneath the surface of the Arctic Ocean.

Parky showed no signs of tusks; his two front upper canines had not yet developed into these specialized structures possessed by the grown walruses. Only the flat molars which just protruded above his gums gave any indication as to his future inclinations toward a clam diet.

As he now nestled drowsily beneath the protection of his parents, he little dreamed of the numerous dangers which constantly beset the herd. A young walrus would make a tempting and easily captured meal for a hungry polar bear; but this danger was small, at least in this period of walrus history, compared with the destruction wrought by two-legged creatures who killed from great distances. Every winter Parky's herd followed the growing ice pack southward through Bering Strait and into Bering Sea, keeping close to the outer edge of the floes where open water could be sought for safety.

From the Diomede Islands in the center of Bering

Strait, south to Nunivak Island, range the Eskimo settlements whose inhabitants take great numbers of walrus from the herds brought southward by the ice during the long winter months. Today as long ago the Eskimos hunt the walrus from their native umiaks, long walrus-hide boats, constructed of a framework made from driftwood lashed together with seal and walrus-hide thongs. Most likely though, these craft would not be propelled by the ancient paddles or oars, but by 25-horsepower outboard motors, which literally cause the craft to skim over the water. And rifles have largely taken the place of the cleverly devised native harpoons which, instead of allowing many a fatally wounded walrus to sink, held it captive on the end of a rawhide line.

With the deadly rifle the natives hunt their traditional game, the walrus, often killing great numbers of them not so much for food as for the ivory tusks which, when carved into various useful articles, are traded profitably with the white man from the south.

Parky knew nothing of these dangers which existed to the south of his summer home in the Arctic Sea. He had never seen the destructive creature who walked on two legs until one sunny July day when a large white ship loomed on the blue-gray horizon.

A fateful sound

The hum of an outboard motor propelling a skin umiak, and the muffled roar of a white power launch broke the stillness of the great ice-dotted sea. Only occasionally would a one-ton bull rise on his fore-flippers to look into the distance and perhaps emit one or two half-hearted bellows of defiance. Parky's parents lazily looked up and then relaxed again into a coma of indifference.

But now the launches approached closer to the herd. Walruses on the outskirts began to waddle off the ice into the water. Those with young pushed their offspring toward the sea.

Suddenly! two, three, perhaps more rifle shots cracked above the general roar of the now awakened herd. One bull, distinguished from the females by his heavier and thicker tusks, was hit, but before death overtook him, he slid off the edge of the ice, sinking from sight. Following the gun reports, a general alarm swept through the herd. Like a well-trained army they slid, angry and frightened, off the ice. In the churning water, several of them headed for the two boats. Parky found himself catapulted into the sea and carried along in the confusion of great, powerful moving bodies. The umiak quickly turned and retreated toward open water. Its Eskimo occupants knew only too well from past experience that an angry walrus would not hesitate to ram its tusks through the skin bottom of their frail craft. The launch, though, lingered awhile. One maddened walrus attacked. A rifle was carefully aimed at the oncoming foe. Then click, something had gone wrong with the gun. The walrus had time to dive beneath the launch, striking the wooden hull with his tusks. Not even the planking stopped the powerful thrust. The ship's carpenter was busy that day repairing a hole in the bottom of the boat.

Capture

Again the following day two moving objects came away from the white ship and once more approached the docile herd. Parky's family were oblivious to the world. The summer sun was warm, making sleep the most pleasurable pastime. The umiak approached the ice pan upon which the family sprawled. Their bit of ice had drifted some distance from the main herd. Only the three lay upon it.

Approaching closer, the outboard was silenced. The umiak drifted quietly up to the ice, and a fur-clad figure raised his gun. A few shots, that was all, Parky's parents lay dead on the floe.

Only after their death were the crew of the umiak willing to land on the ice. Although the bewildered youngster could easily have taken refuge in the sea, he refused to leave the side of his slain mother. Several rough hands were laid on his struggling form. He was protestingly dragged to the umiak, rolled into the bottom, and securely tied to the boat's framework.

As the umiak leaped through the small waves, back toward the large ship, it seemed to express the joy of its crew over their final success in capturing a young, live walrus. But Parky felt no joy as the umiak drew alongside the ship, and he looked up into numerous, staring faces of curious humans. A cargo sling was dropped into the skin boat, and he was rolled into the net. The chugging of the winch announced his ascent. As he was swung through the air, his vocalizations ceased, only his globular eyes expressed the panic he felt. That was until he found himself on solid footing again. On ice? No, something just about as cold though, a hard iron deck.

* * * * * *

This is what we can piece together of Parky's life before he met man. The vessel on which he found himself was the motor ship *Stranger,* of Los Angeles, California, on cruise in Alaskan waters. One of the vessel's aims was to obtain Arctic animals for the San Diego Zoo. There was great excitement on board when Parky was lowered to the deck, excitement which confused the 150-pound baby. In bewilderment

Parky clumsily untangled himself from the sling and lumbered about the deck, bellowing with fear.

For some strange reason Parky found a particular attraction in the drain in the scupper. Placing his mouth over it, he would suck with all his might, producing a sound like a pump sucking nothing but air. Perhaps he was hungry and his desire for food even overcame his panic which his strange surroundings had brought on. Pathetically he attempted to locate his mother.

But Parky, like many other infants, was remarkably able to fit into new conditions and he was able to sleep away his troubles soon after he arrived on board. After perhaps an hour or so of wild clambering from one side of the ship to the other, he curled up in a corner and went to sleep. But what a noisy sleep! One would think he would wake himself up. No, it wasn't exactly snoring. There was no rumble of the breath going in, only the hiss when it came out, like the escape of compressed air from a vent.

A young Alaskan hair seal had been on board for about a week, and had been named Muckluck. As "muckluck" is the term applied to the Eskimo sealskin boot, it was decided that the young walrus should be called "Parky," which is the Alaskan word for a hooded jacket. Parky and Muckluck became the most interesting pets on the ship.

It was about two weeks before Parky would feed himself. For several days he sulked in the corner of his cage. His new home was cleverly built by the ship's carpenter, with a pool about two feet deep for bathing and a platform on which Parky could rest. At first his mealtime was a rather strenuous event, with two men holding him and one forcing nourishment between his bristle-like whiskers, over which during the struggle most of the milk drooled to the deck.

Bottle-fed

Parky was fed from a large bottle containing about two quarts of milk, some water, and a little cod liver oil for his vitamin. As time passed, the strenuous periods of forced feeding became less of a struggle. Gradually the bottle became to Parky not an object of fear but of pleasure. By the time the ship in its southward journey had again entered the Pacific Ocean, he was consuming about a case of canned milk every two days.

After a bit, Parky did not shun the strange humans who came about his cage making queer noises, or trying to touch him. In fact, he began to enjoy their presence, especially when they would pat his head or allow him to rub his bristly mouth across their hands.

Like most infants, he loved to show off. When an audience was present, he would stand in his tub of water on his hind flippers, placing his fore-flippers against the sides of the enclosure. He would look at you a moment as if to say, "Well here goes!" Then he would flop over backwards into his tank; and with grunts merging into gurgles as he sank, he would disappear completely. A few moments would pass, then his rise to the surface would be indicated by the bald hump of his head, which arose like a rounded back of a miniature whale returning to the surface after a period of abysmal wanderings. His pig-like eyes would next again see daylight, then his Fuller-brush whiskers appeared. Only Parky's comical face protruded above the surface, looking at you as if to ask, "Well, how was that?"

Parky found great interest in the large salt water hose which was used to wash down the ship's deck and also to fill his tank. The hose was often left running in the tank. He would occasionally persist in pushing it out onto his platform and seemed to enjoy playing with the snaky rubber tube, which gushed cold water all over him.

The pet of the ship

Parky had become spoiled; perhaps that was the major reason leading to his downfall. He had come to be a tame and affectionate pet. Whenever left alone, if not asleep, he would more than likely begin bellowing for attention, food, or both. The crew certainly answered Parky's demands for attention, petting him whenever they passed his house. His caretaker, of course, was not quite so liberal with the feedings.

Parky's skin was thick, yet tender. It cut easily; several gashes about his neck showed this. These injuries did not seem to heal. As the ship neared British Columbia, Parky became quite ill. Perhaps he caught cold, if such is possible for a walrus; or maybe the large quantities of hay stored beneath his quarters in the well deck affected him in the same way that it does penquins, by producing a fungus growth in the mouth. At any rate, Parky was never to see his destined southern home in the San Diego Zoo. Perhaps it was for the best, for the balmy winters of that southern town are not in keeping with the cold in which his relatives thrive.

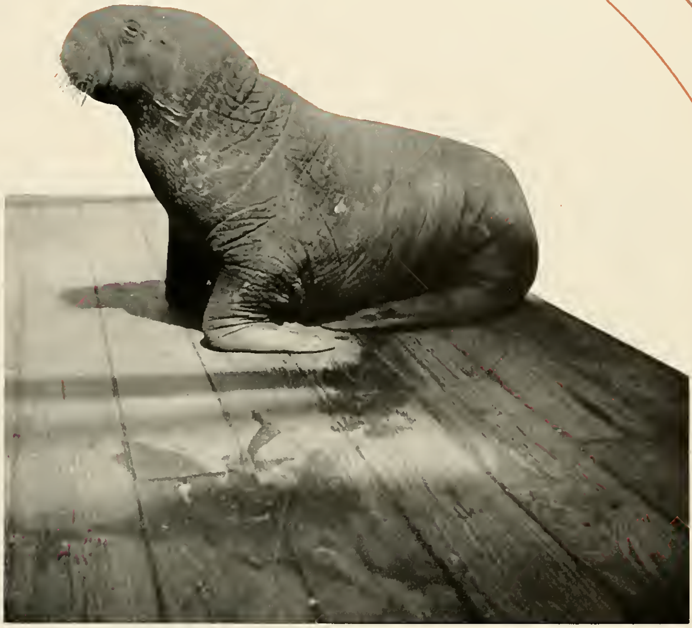
Parky's death marked the conclusion of an acquaintance with a unique and interesting animal, an animal whose intelligence seemed equal to the California sea lion's. Those who might have seen him in the confines of a zoological park would never have known the little animal who, in a state of semi-captivity on the deck of a ship, had amused so many with his lively antics in the brisker climate of his homeland. Let us hope that Parky's passing is not an indication as to the future of his already declining race.

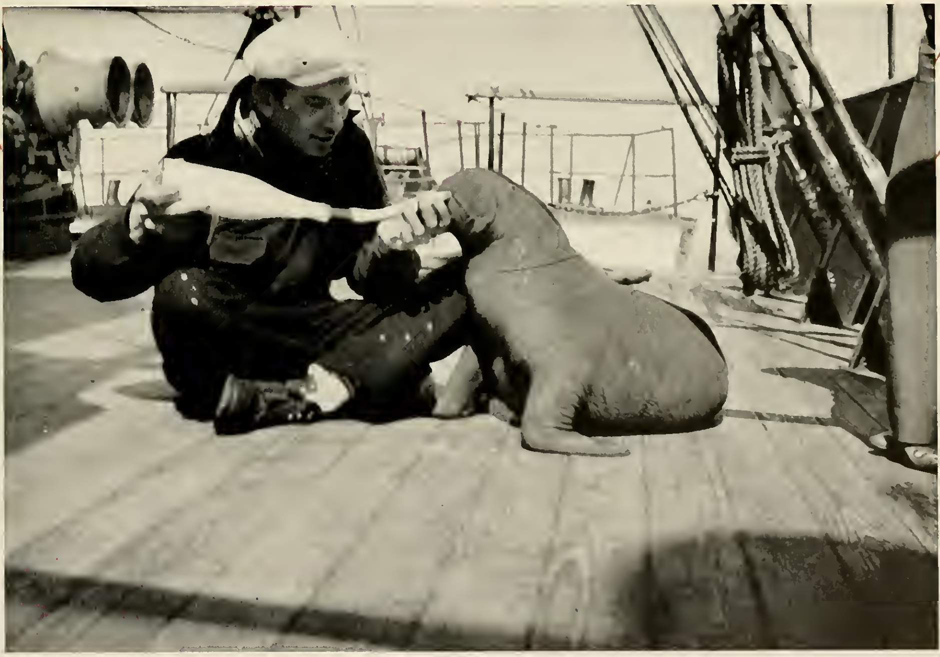
(Above and below) EVERY WINTER walrus herds follow the growing ice pack south to Bering Sea, keeping near the edge of the floes where, at a moment's notice, Parky's mother could push her offspring into the comparative safety of the water

(Right) WITH MOTHER—but not for long. Only after his parents' death did the two-legged enemies dare to roll Parky into the bottom of their skin boat

ON DECK. The *S.S.Stranger's* passenger, bound for the San Diego Zoo (which he unfortunately never reached), became a tame and affectionate pet. Parky responded to his appreciative audience with lively antics; for, like most infants, he liked to show off

(Below) AT FIRST it took three men to force nourishment through his Fuller-brush whiskers, but he was soon guzzling his bottle without fear





THE BIOGRAPHY OF CHELYDRA—*Long-lived snapping turtle, fierce, sullen and unthinking creature whose enemies are thwarted by the house he wears on his back*

By Roy L. Abbott
Professor of Biology, Iowa State Teachers College

The biographer of such a notoriously long-lived creature as a snapping turtle is of necessity embarrassed by the shortness of his own life span. Especially is this true if the biography attempts to record the writer's observations throughout the life of any individual turtle. But if he has seen, as has been my good fortune, fragments of the lives of many individuals of the same species—the mating and egg-laying, their birth, infancy, youth and age, even their death—is it not permissible to set these parts of lives down as one synthetic whole? At any rate, after over 40 years of observation, I present you with the composite story of the life, as I know it, of Chelydra, the snapper.

The summer sun from June to September had beaten upon that sandy spot in the watermelon patch. There, several inches below the surface, lay 20 or more round white eggs, appearing for all the world, except for their slightly smaller size, as if someone had buried a quantity of ping-pong balls. I was certain of this because I have dug up snapping turtles' nests, and in this case, because I had come upon the old female at her egg-laying that June morning and had marked the nest site of which I now tell. But early as I was that day, she must have begun her journey far earlier, for the nearest water was a creek at the bottom of a steep, wooded bluff, perhaps 200 yards away; and even then, as I found her, she was backed into the soft soil to a third of her length, just completing the job of egg-laying. I did not see her dig the nest, but from watching others, I know that she did it largely with her webbed hind feet, perhaps aided somewhat by her powerful tail, and that after depositing her eggs she crawled out, pushed dirt into the hole, flattened it down a bit with her under-shell and then slowly moved back to the creek, her heavy tail marking a curving line between her widely-spread tracks as she went. The whole process seemed casual enough, and although she threatened me with her great jaws when I first came upon her, I doubt that she fended me off as being in any way a possible depredator of her offspring, nor that her maternal feeling on that occasion was any more than a vague inner urge to get rid of the crowding eggs. Certainly, so far as I know, she never revisited the nest site, probably, indeed, never saw any one of the youngsters that came from the eggs, and perhaps, never again met the big male who sometime before, had done his part in providing for the new generation.

Turning eggs into turtles

Seemingly indifferent as Madame Snapper was to her eggs, she had at least placed them in a suitable spot on the land, a thing which every other egg-laying reptile does regardless of habitat, and Mother Nature, in her inscrutable way of looking after her children, had seen to the rest of the job—the job of turning the eggs into turtles. Nor was it any little task, for those rubbery shelled eggs were at first only masses of food and water and protoplasm—organized masses, it is true, but as yet having no internal resemblance to a turtle, looking instead very much like birds' eggs, a central core of yellow surrounded with a watery white just inside the shell. It takes four months or thereabouts to change this egg-content into a fully-formed snapper, four months of cell division and tissue formation, of shift and change and organ-making, not the least of which is the building of the creature's upper-shell. For early in development, that structure, appearing as a sort of raised area in the center of the back, grows rapidly outward and downward over the rest of the embryo, somewhat like thick lava capping a low mountain, and, incorporating itself with the ribs, soon spreads enough to pull even the shoulder and hip-girdles under its protective roof. This upper-shell eventually fastens itself at the sides to a similar flat plate of bone at the bottom of the embryo. Hence the snapper, willy-nilly, and in common with all turtles, comes into being all boxed up, confined paradoxically to a sort of open box—open at the ends for protrusion or retraction of head and tail, and also at each corner for free action of arms and legs.

Many turtle nests that I have marked for study have been dug up and destroyed by some predatory animal. The common skunk is notorious for his destruction of the eggs of the snapper. But this particular clutch escaped injury, and my 20 young snappers—as I had the good fortune to meet them there that September day on my daily trip to the nest—seemed in nowise discouraged by their physical limitations. Indeed, boxed up and feeble though they were, I couldn't help thinking that they had gotten a long way from the tadpole, gill-breathing stage of their frog-like ancestors; and they had at least one advantage over most of the newborn mammals, for their eyes were open from the first. Nor were they bothered by the fact that they were far from water. Stretched out in a ragged line, with all the seeming assurance of a hundred million years of reptilian success behind them, they were heading straight for the creek which was at the foot of the bluff and at least 30 feet below their line of vision.

How did they know where they were going? Who knows? G. H. Parker, of Harvard, studied young loggerhead turtles and concluded that they went down to the sea as a response to the more open horizon in the seaward direction; and other observers of newly-hatched snappers state that they go towards the largest illuminated area. But certainly other factors were operating here, for the brood was heading eastward directly into and through a high hedge-fence, with the wide, open horizon at their rear.

No snap to be a snapping turtle

And how many of my 20 hatchlings survived the vicissitudes of the next ten or fifteen years, or whatever time it takes for a snapper to arrive at the full status of snapperhood? Again, who knows? Certainly there were dangers aplenty. Not from lack of food, for fall-hatched turtles can go until the next spring, even far into the following summer, with little or nothing in the way of sustenance; they appear to carry a considerable reserve of food from the egg. But I took a baby snapper (measuring one and one-half inches across the shell) from a bullfrog's stomach a short time ago, and one of about the same size from a three-pound black bass. Hence, when they first arrive at the water as soft-shelled, swimming, half-dollar-sized infants, they are doubtless tempting and easy morsels for those creatures—scaled, feathered or otherwise—that live by gulping whatever prey of suitable size moves within range of their jaws.

Regretfully, I now realize I missed a chance the day I met those little snappers trekking from their birthplace down to the creek. For had I captured two or three and kept them through the years, I would now be able to give some accurate data upon their rate of growth, of which we at present know but little. A. S. Pearse and Edward S. Hathaway found that two Western painted turtles, which they tagged and subsequently recaptured, had grown just less than a third of an inch in shell-length in two and one half years, and from this they calculated that five-inch turtles of this species would be about twelve or thirteen years old. According to Clifford H. Pope, a Marion's tortoise is known to have lived on its "native Island of Mauritius from 1766 to 1918 when it was killed in an accident." He also cites that snapping turtles have been kept in Europe for periods up to 20 years.

Full snapperhood comes slowly

Well, I too, have two large snappers. I caught them in 1920, and they have been under my constant observation ever since. But unfortunately I did not measure them when first captured, and although still active and vigorous as ever, they do not appear to have grown very much in 20 years. Contrary to the usual run of affairs, the male is somewhat larger than the female, weighing about 20 pounds. But how old were they when I got them, and how long does it take a snapper to grow up?

A tiny one, which I have kept in my office for the past full year, has gained exactly eight-tenths of an inch in shell-length, and now measures just two inches—a small gain, considering that he has fed greedily upon liver, meal worms, and earthworms for most of that period, sometimes consuming a dozen fat meal worms at a single feeding. Does this mean that snappers grow very slowly?

But to return to my hatchling snappers as I watched them take to the creek that day. I have already asked how many of them survived that first dangerous year, becoming full-fledged turtles at least ten or fifteen years later. Of course I couldn't follow them beyond their disappearance into the water, but it's a safe bet to say that, being 20 in number, they had similar but twice the troubles of the "ten little pickaninnies." Doubtless one had scarcely reached the water when a bullfrog swallowed him; another, lying momentarily at the surface, was taken in a furious rush by a big bass or a pickerel; and a heron, mayhap, gulped a third. Before the end of the next year, half of them may have disappeared—the substance of which they had been composed, by the alchemy of Nature, now rebuilt into other creatures, whose fate it was in turn to be transformed into yet another. And by the end of fifteen years, if snapping turtles be full grown by that time, how many would be left? The mathematics is simple enough: at least two, if the species is to keep constant its numbers. But since the snappers are on the decline in these parts, only one is left, a huge fellow, fourteen inches in length of shell, with a neck as thick and long as a man's upper arm: *Chelydra serpentina*, the scientists call him. And from here on, may I not epitomize in the life of this one snapper, all the ways and doings of the several snappers I have met?

A tough constitution

Chelydra came first to my experience in the role of a fish-stealer. Fishing that day in a Mississippi River slough, my attention was caught by a succession of sunfishes which came floating slowly past, each appearing to have a large piece scalloped from its side. On investigating my catch, which was tied up stream, I found a huge snapper cutting a fish from the string at every bite and carving a mouthful from each as cleanly as I might bite a piece from a pie. I drove him away with a .22 rifle, but the hasty shot landed pretty far back, and knowing his amazing toughness of fiber, I suspect that he may still be alive. For he and his kind can stand a great deal of injury and still live. Raymond L. Ditmars tells of finding a turtle on the field of Bull Run a few years ago—a turtle hale enough, but whose healed shell showed all signs of having been once nearly cut in two. "A minnie ball," suggests Ditmars.

Well, it is credible enough, for I found a Blanding's turtle with its shell showing signs of having once been stepped on and crushed, perhaps by a horse. Its carapace was smashed down an inch or more, yet the animal appeared otherwise normal, and the shell thoroughly healed.

Chelydra, like many other turtles, hibernates in the wintertime, often remaining buried in the mud from November to April. Of course he does little lung breathing during this period. Though he may even remain under water for hours when not hibernating, he is an air breather during his active hours, and will drown if compelled to remain under water too long. I discovered this latter fact rather incidentally a few years ago when I went with a friend to help find a hoop net which had broken from its moorings. The net had disappeared for several days, and we finally found it floating, buoyed up by the gas-filled bodies of several large, drowned snappers.

I met Chelydra again—in rather a collective sense this time—when I set out not long ago to prepare nine large snappers for dissection in a zoology class. These nine were fresh from the creek; and, although I'd never tried it before, I decided to use a lethal chamber on them—natural gas turned into a telescoping pair of tin tubs with a water seal. It had worked admirably on cats; but after tumbling the snappers into the box, turning on the gas and waiting 30 minutes, I was not prepared for what I found on lifting the lid. For each of the nine lay there calmly regarding me with their little, yellow-gray eyes, as fierce and ready for battle as ever. I tried them for a second period, but it was of no use. I believe they took only a sniff of the gas and then knocked off breathing so to speak. Although both the silence and my astonishment were profound as I viewed them, I had a sort of guilty feeling that they were asking me: "Why did you turn that vile stuff in here?" Nor could I find a very satisfactory reply to the query.

I met up with Chelydra still another day. Perhaps a mile from the nearest water, he was apparently migrating overland from one pond to another. He was making pretty good time at that—I guessed a mile per hour—holding his under-shell at least an inch off the ground, and with tip of tail dragging. He apparently knew also where he was going; for, although he stopped and struck savagely at my dog, turning quickly in circles to keep his head-end presented to his tormentor, when we left off teasing him, he started off again in the same direction.

Another one that I picked up while on an automobile tour was placed in the rear of my car for further examination, but I promptly forgot the creature. Although it endured the dust and heat of those cramped quarters for two weeks, it seemed but little the worse for the experience.

Savage disposition

But for all these sporadic meetings, my real acquaintance with Chelydra began with the one I captured in a minnow net just 20 years ago. He, along with a somewhat smaller female, was hauled out of a duck pond and transferred by means of a gunny sack to a pen in my back yard, and later to a greenhouse where the two have been ever since. Both were plentifully sprinkled with leeches, particularly around the eyes and under parts of the legs and body; and both were doubtless infested with internal parasites, such as trematodes and roundworms, for I have never yet found a snapper free from these. Both, too, were fierce, lunging brutes when first captured, striking out savagely at whatever came near, often grabbing each other's jaws and holding on like bulldogs.

But after a few days, they quit striking blindly at each other, or at me, and will now even take food from my hand. But their savage disposition is still with them; and, although less fierce than formerly, they still resent handling.

Shortly after capture, one or both—I couldn't be certain—disgorged half a pint or more of the seeds of a common water plant, some species of Potamogeton. Does that mean that snappers are vegetarian when necessity requires?

Be that as it may, my two specimens have subsisted solely on meat for 20 years—meat from an astounding variety of animals. In fact, I have found little or nothing of an animal nature that they won't devour living or dead, seemingly taking fresh or putrid meat with equal gusto. Mine have eaten dozens of rats of both gray and white varieties, sparrows, pigeons, frogs, tadpoles, salamanders, crayfish, ground squirrels, fish, earthworms, grasshoppers, and even one young turtle of their own kind. They will often seize a tough old barn rat, one at each end, pulling and mauling it for a half hour. On several occasions, I have watched the big male swallow a large barn rat whole, gradually ingesting it by prodigious gulpings of his thick, muscular neck. Regardless of kind, however, the food is always eaten underwater; for, as far as I can observe, the snapper is apparently unable to swallow in air. Chelydra always strikes from below at an animal swimming on the surface, with an amazingly quick serpent-like stroke, followed instantly by a retraction of the head to drag the victim beneath the water. There are no teeth in Chelydra's head, but his mouth is rimmed with a sharp, cutting edge, and the tips of both jaws are beaked like an owl's. Watching one of these deadly submarine attacks, it is easy to see why a snapper-infested pond is no place for young ducks, or for that matter, young muskrats or minks.

Ability to remain submerged

Except when hungry, Chelydra usually lies quiet, his algae-covered shell melting beautifully into the general pattern of plant life about him. Indeed, mine in their cement tank, seemingly go hours on end scarcely moving, except now and then to thrust their heads momentarily above water for a short breath. But even this need not be often. I tied one to a large rock a few days back, forcing it to remain submerged for two and one-half hours. There was no sign of injury, and he probably could have remained under much longer.

Like all reptiles, Chelydra is cold-blooded, his temperature being about the same as his surroundings, which means that when the water is cold, he is cold, and his physiological reactions correspondingly slow. Experiment, in fact, has shown that he digests twice as rapidly at 84°F. as he does at 64°F. Even with this in mind, it is difficult to see how he disposes of so much food, especially when Francis G. Benedict has shown that the energy needs of a ten-pound turtle could be satisfied for a month by about seven ounces of banana.

And how long will this pair live? I have already implied that the dangerous age for turtles is the egg-stage and the first few years after hatching. Chelydra seems to have but few enemies, aside from man, capable of doing him any harm once he has arrived at maturity. One of mine actually endured the assaults of an eight-foot alligator, appearing to suffer little harm from the alligator's vigorous but futile attempts to crush him. Hence, my snappers, now perhaps 35 or 40 years old, bid fair to outlast their biographer. They appear as hale and hearty as the day I first met them!

His fallen estate

Sometimes I creep quietly up to the tank and watch these two big reptiles without their knowing of my presence. To see them lying there submerged, resting on the bottom with their huge heads half projected, is usually sufficient to start a chain of biological thought. I am looking at creatures whose ancestry runs back nearly 200 million years, if the paleontologists are right. The ancestors of the snappers first hit upon the anatomical principles of a dry skin and shelled eggs with a protective amnion and an allantoic breathing-device, and were thus able to get away from the water and really occupy the land—something which their amphibian ancestors could never do. When I reflect, too, that of the 25 or more orders of reptiles that once occupied the land only four or five are now in existence, there comes a kind of pity for their fallen estate. But I lean closer and my shadow, darting across them, arouses their attention. Two pointed noses touch the surface, a few bubbles escape—and I am back again to the present. I see before me two great, bulky creatures, fierce, sullen, unthinking—creatures whose existence appears largely vegetative. Each has arrived at his present size by incorporating whole hecatombs of animals into his body—and when I look at his ugly, unprepossessing form, I am constrained to ask: To what purpose? But that is a part of the lure of him and his kind.

HARD SHELL—SOFT SHELL

Some 20 times in the course of its short life the hard-shelled crab discards its clothing to become temporarily the soft-shell of the epicure

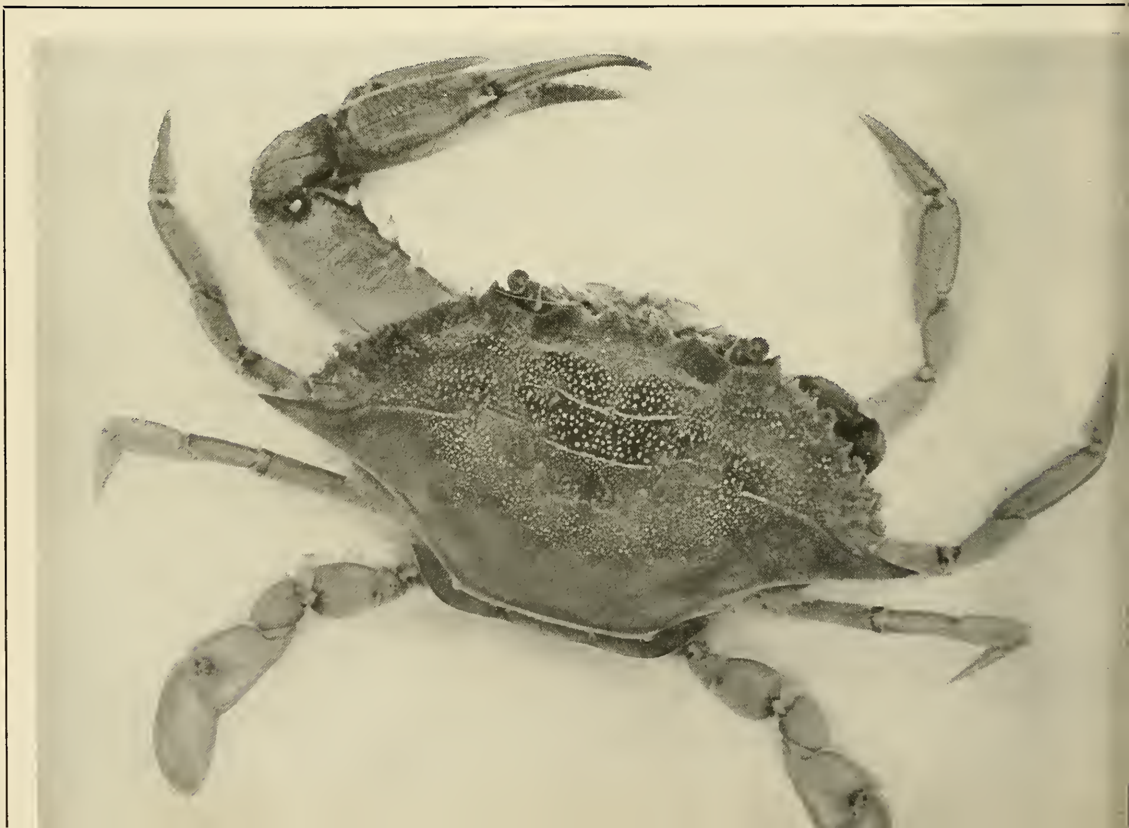
By JULIAN J. CHISOLM II

When eating a soft-shelled crab, many persons imagine they are dealing with a special species. This is not so, for a soft-shelled crab is simply a regular hard-shelled one that has shed its shell and not yet formed a new suit of armor. Like every animal that has its skeleton placed on the outside of the body, the crab shown here *(Callinectes sapidus* Rathbun) must throw off this shell to increase in size after the old shell has been filled with expanding body tissues. During the life of the animal, which averages about two and one-half years in females and three to four years in males, this operation is repeated 17 to 20 times.

Crabs, also, have marked powers of regeneration of lost appendages such as legs, claws and paddles. These are frequently lost in the struggle for existence and are replaceable in all except the last stage of growth.

To facilitate the discarding of an appendage, there is a breaking point on its basal joint known as the "fracture plane." When the appendage is held or injured, a special arrangement of muscles breaks it off at that point. A diaphragm closes the end of the amputated leg and prevents both infection and loss of blood. Subsequent to this development, the adjacent cells rapidly proliferate to cover the injured area.

A few days after an appendage is lost, a protrusion occurs at the point of the break and continues to grow, in bud fashion, until a large sac is formed, which gradually takes the shape of a new but nonfunctional member. This covering is discarded the next time the crab sheds. If sufficient time has elapsed for the new appendage to reach maturity, the animal now has a new functioning limb which is somewhat smaller in size than a normal one. It takes at least two full sheddings on the part of the crab for a regenerated member to equal a normal one in size. A



A new suit for the blue crab means growth

crab may lose as many as eight or ten of its appendages at one time and still carry on and develop new ones.

The first indication that a crab is ready to shed is a dark line that develops around the two outer segments of the paddles. In several days this line changes to white and then to a light red or pinkish color. This development, along with a certain wrinkled condition that shows up inside one or two of the claws, indicates that the crab is ready to shed. At this time it is known as a "peeler" and it seeks the protection of a grassy bottom in shallow water, for after the shell has been shed the animal is soft and defenseless for two or three days.

The shell or carapace of a crab fits snugly to the hard parts of the lower surface but is not attached to them, so, at the rear margin of the shell, a gap appears as the "rank peeler" starts to throw off the old shell.

Shedding is a very tedious and intricate process involving considerable time and much muscular effort, with many curious motions and actions on the part of the crab. By virtue of the writhing motion of the animal, the carapace is forced upwards and the soft posterior of the crab protrudes through the opening. The greatest difficulty appears to occur while withdrawing the legs, especially the claws with their small joints. To facilitate this operation, a triangular piece of shell in the proximal end breaks loose, greatly simplifying the maneuver. Twisting, twitching, and jerking continue until the crab is completely free of the old shell.

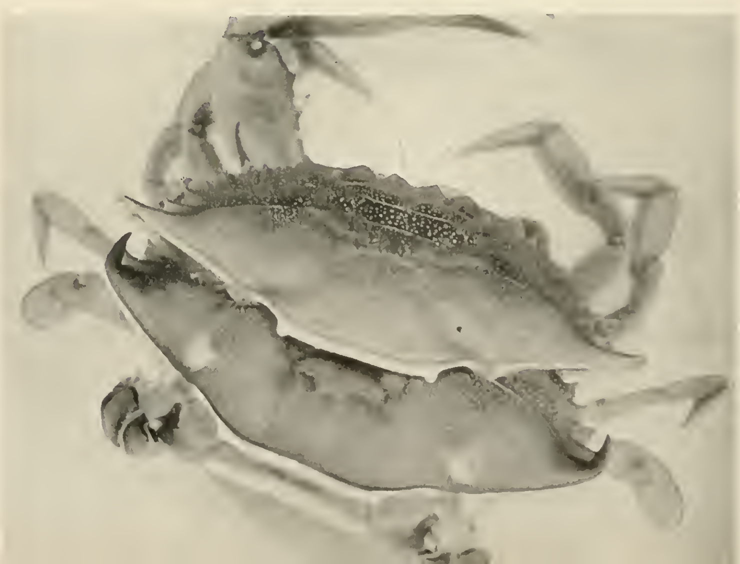
Almost immediately upon shedding, the spines recover their normal form, the legs are adjusted, and the animal is capable of locomotion. It becomes quite active and alert, being able to swim and walk in spite of its extreme softness.

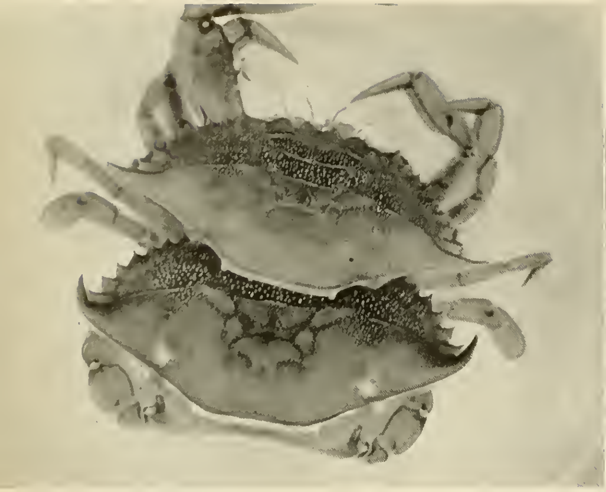
In two to three days the shell becomes hard and the crab starts to feed. At this stage it is known as a "buckram," and the body has spread to larger proportion. A crab gains about a third in volume with each shedding.

The photographs, taken in chronological order, show the various stages in the actual shedding process of a crab which had but one claw, and illustrate the powers of regeneration of a lost appendage.

1 *(Left)* 11:45 A.M. A HARD BLUE CRAB at the start of shedding. At this stage it is known as a "buster." The shell or carapace of a crab fits snugly to the hard parts on the lower surface but is not attached to them. In shedding, a gap appears at the posterior margin of the shell which continually opens as the carapace is forced upwards by the soft body of the protruding crab. Subsequent to its last shedding, this animal lost its right claw or chela. A sac-like growth can be seen in the place where the right claw should be. This is the new claw in the process of regeneration

2 *(Right)* 12:12 P.M. SHEDDING is a tedious and intricate process, requiring considerable time and much muscular effort, and involving curious motions and actions on the part of the crab. The carapace has been forced well up, and the posterior of the body with the paddles is nearly free of the shell. The sac containing the regenerated claw can still be seen. Notice the crack which has appeared in the left claw near the base. As this shell breaks away, it facilitates the withdrawal of the claw

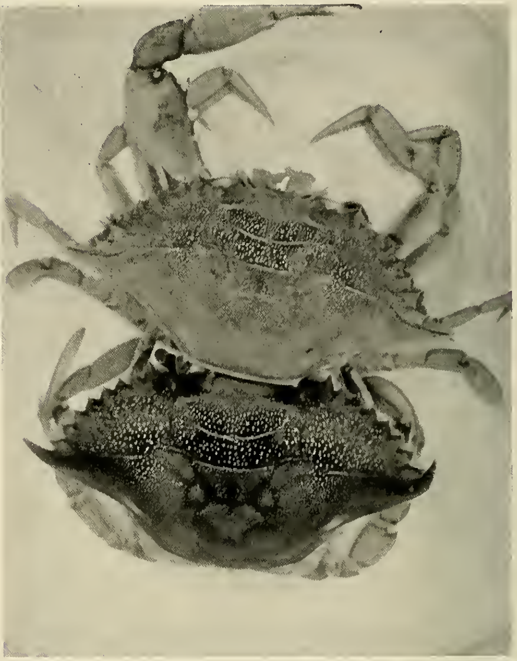


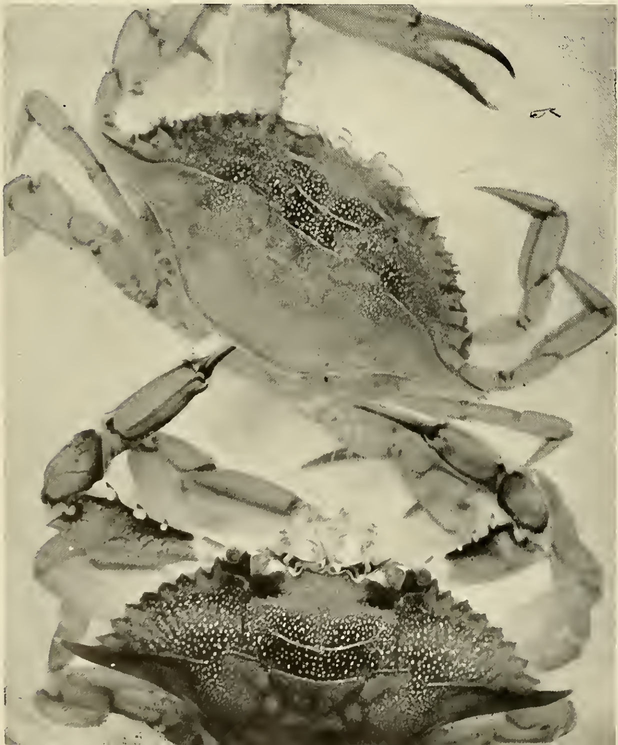


3 *(Above)* 12:17 P.M. WITH MUCH TWISTING and squirming the crab has succeeded in getting the greater part of its body free of the old shell

4 *(Right)* 12:22 P.M. AFTER A STRUGGLE of 37 minutes the body and legs are free of the old shell. At this point the greatest difficulty is experienced, that of withdrawing the claws

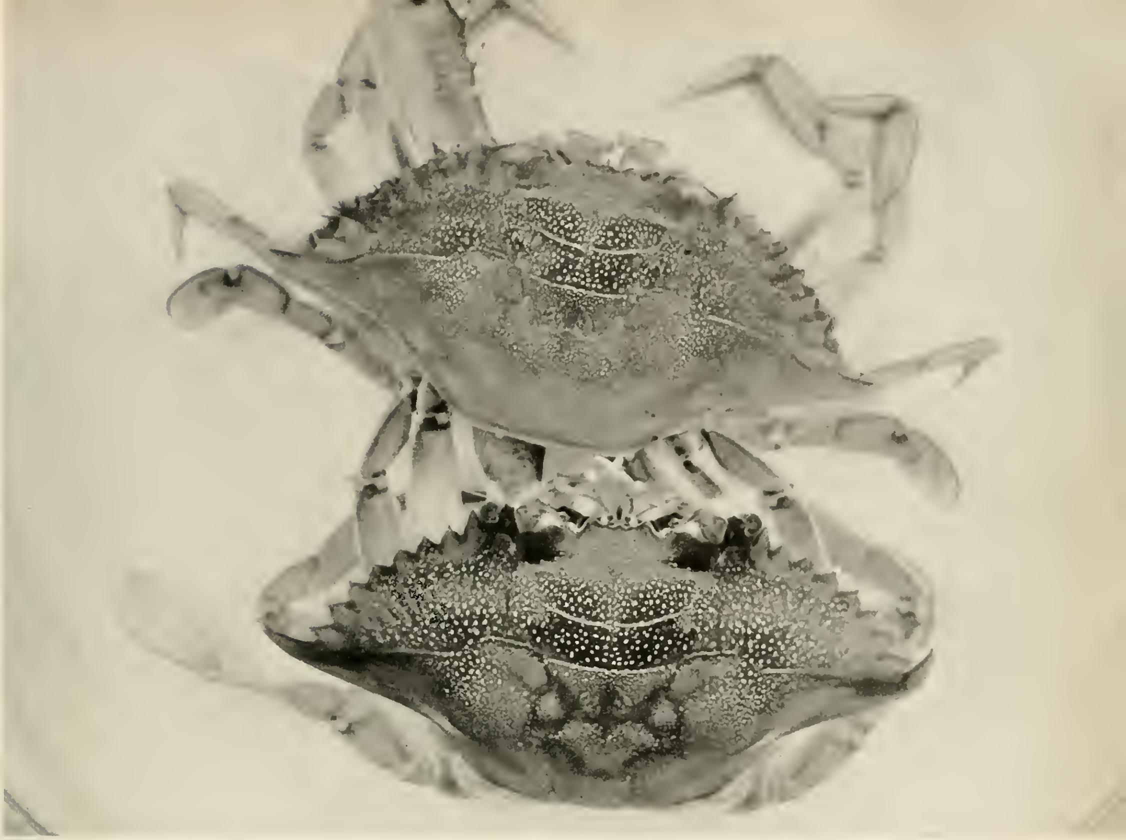
5 *(Opposite page)* 12:24 P.M. TWO MINUTES of frantic kicking and other gymnastics and the claws begin to come out



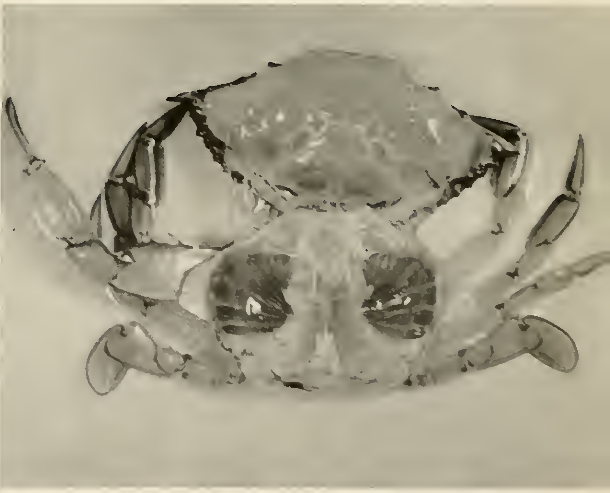


6 *(Left)* 12:28 P.M. SHEDDING IS COMPLETE. Note the perfect regenerated claw on the right. It is not as large as the left claw but will be after the next shedding, if nothing further happens. The crab's body is now extremely soft and is defenseless against its enemies. It will lie in hiding for two or three days while the shell hardens before venturing forth to resume feeding

7 *(Right)* 12:36 P.M. THIS SHOWS the increase in body-size after shedding. On top is the cast-off shell and beneath it the soft crab that came from it. Under normal temperature and feeding conditions, a crab gains about a third in volume with each shedding



8 *(Right)* THE CAST-OFF SHELL with the carapace opened forward to show the inside. As a result of shedding, all the hard skeletal parts of the crab are discarded, including the mouth parts, eye coverings, stomach lining, and gill coverings



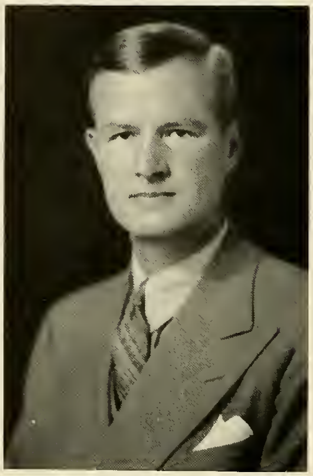
BIRDMAN OF THE OPEN SEA

The career of Robert Cushman Murphy bears witness that the Age of Discovery lives on. For more than a quarter-century he has explored the oceanic waters off South America to spread before the world an entire new field of Natural History

By D. R. BARTON

WE HAVE seen in the careers of several Museum men how large the continent of South America looms in the general field of biological inquiry. Junius Bird,[1] the archaeologist, investigated this 3000-mile-long, wedge-shaped land mass that cuts across all climate zones, from the standpoint of the human beings who dwelt thereon during the past 20,000 years or so. He explored caves and other natural depressions, dug shallow pits, and brought forth artifacts classifiable, for the most part, on the basis of man-made "sediments" or layers of refuse. Owing to the comparatively late date of man's entry into the scheme of things, the archaeologist is not forced to rely so heavily on geological stratification as do paleontologists like George Simpson[2] who penetrated much deeper into South America's crust in search of the fossilized remnants of creatures dead these 60 million years and more. Thus do the manifold investigations which the Museum carries on in South America require downward penetration to varying depths. The reverse is also true. Frank Chapman[3] and Harold E. Anthony[4], among others, have carried the Museum's banner upward into the Andean peaks to collect specimens of birds and mammals in various high-ranging and sharply defined life-zones which reward the investigator with a remarkably varied gradation of fauna.

Having explored many of its plains and river basins, plumbed its depths, and scaled the summits of its loftiest mountains, it would seem that the Museum had exhausted all possible types of locality in South America. Yet it has remained for Robert Cushman Murphy to help establish and venture upon an entire new field of study, which proceeds laterally from the world's longest coast line into the waters of the Atlantic, the Pacific, the Antarctic oceans and the Caribbean Sea.


Blackstone Photo
ROBERT CUSHMAN MURPHY

With such a bailiwick marked out for his own, Doctor Murphy has become the Museum's Ulysses, having probably served more years before the mast than any other curator. And, towering above his colleagues to his full 6′ 3″, he looks the part. During one South American cruise, he was bitten by a fer de lance. No fatality occurred, Roy Chapman Andrews later explained, because the recipient of the bite is so skinny the fangs simply pierced the leg, ejecting the venom harmlessly on the other side. As a matter of fact only one fang penetrated, but the venom stayed in the skin for some time, causing Doctor Murphy to limp painfully even after he had returned to the Museum. It troubled him psychologically, too. When he was least thinking of it, he would suddenly feel that fang sink into his flesh again. How the snake felt about it he does not know, but the foolhardy creature is generally believed to have died instantly as a result of the encounter. Though Murphy is on the slender side, Andrews' remark does not do him justice. Robust and aquatically minded from the start, he made the Brown University swimming team in college days and was capable of replacing the stroke oar in a whaleboat during his first expedition in 1912.

Brooklyn beginnings

Robert Cushman Murphy grew up near Port Jefferson, Long Island, where he lived in close contact with the birds of the sea and land from earliest childhood. His family wintered in Brooklyn, and there he made the acquaintance of George K. Cherrie and a number of other men in the Brooklyn Museum, absorbing considerable nature lore from conversations with them. He did a good deal of amateur schoolboy collecting of all kinds and eventually accepted a post on the Brooklyn Staff as Curator of Mammals and Birds (1911-17) and, later, Curator of Natural Science (1917-20). However, his connection with that institution was not without interruptions.

One day in 1906, Bob Murphy, then 18, wrote a letter to Curator Frank M. Chapman, whom he knew only by reputation, asking for a job at the American Museum. Chapman replied that he could give him work at $40 a month. This figure did not coincide with Murphy's own evaluation of his services and he promptly declined by mail. The letter was written on Saturday. Then, over the weekend, he reconsidered the matter and changed his mind. On Monday morning he rose early, came in to the Museum, pinched his letter of refusal from Chapman's desk, and sat waiting for the noted ornithologist to arrive. Thus began an association that has endured through the years and, significantly, Doctor Murphy's classic monograph is dedicated to the revered dean of American birdmen.

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[1] See "Archaeologist, Self-Made," by D. R. Barton, NATURAL HISTORY, June, 1939, p. 53; also "Before Magellan," by Junius Bird, NATURAL HISTORY, January, 1938, p. 16.

[2] See "Bone-Digger in a Lost World," by D. R. Barton, NATURAL HISTORY, November, 1940, p. 244.

[3] See "Apostle of the Birds," by D. R. Barton, NATURAL HISTORY, January, 1940, p. 48.

[4] See "Portrait of a Mammalogist," by D. R. Barton, NATURAL HISTORY, December, 1940, p. 304.

But that starting salary was awfully small, and although his family was able and more than willing to help out, Murphy sometimes lived on little more than dreams of the future. He was a proud young man and all he would allow his father to buy for him was a suit of clothes. On one particular occasion he had literally nothing to eat all day. Too proud to ask for an advance, he suffered the pangs in silence until evening when he read proof for the *Auk* with the late Dr. Jonathan Dwight. As he was about to leave, Murphy thought of dropping a gentle hint, but again overcame the impulse. It was only at the last moment that Doctor Dwight asked casually if he wouldn't like to be paid. Murphy snatched the crisp new $10 bill and tore off to the nearest beanery.

Shortly after this brush with starvation, he attended Brown University, graduating with the class of 1911, in which year he resumed his fruitful association with Doctor Lucas, Director first of the Brooklyn Museum and subsequently of the American. It was Doctor Lucas who indirectly sealed his fate as a lifetime investigator of oceanic birds by promoting a sea elephant expedition supported by the two Museums.

Murphy was exceedingly anxious to make this trip, particularly since it offered the romantic attraction of several months aboard the whaling brig *Daisy*. At the same time, he was in the throes of an affair of the heart and very much wanted to get married. His fiancée decided that there was no reason why he shouldn't do both. They married and honeymooned in Dominica and Barbados, at which point Murphy kissed his bride goodby, boarded the *Daisy*, and set forth to court the sea elephants. All his scientific work was, of course, incidental to the skipper's main interest — oil. Murphy pitched in as one of the crew, helped capture 27 sperm whales for commercial purposes, and was in turn helped to collect sea elephants. These aquatic mammals so fascinated him that he collaborated with artist Charles R. Knight in designing a bookplate using one of the animals for the central figure. But inspiration for Murphy's unique career came from the strange and exciting new birds which he then saw for the first time riding the gales in the historic Roaring Forties.

"Much that is well heralded in nature," he writes, "carries a tinge of disappointment when it is finally found. A few things, on the other hand, seem beyond over-advertisement. When I faced my first big tree in California, expectation sank into nothingness. The feeling was similar when for the first time I watched and heard the dual performance of the Skylark. With a handful of such experiences, in which reality can hardly fail to transcend hope, I would group the sighting of a great albatross at sea."

Although few English-speaking schoolboys fail to make the literary acquaintance of the albatross, with Samuel Taylor Coleridge as master of ceremonies, perhaps fewer still ever live to see one. Yet the bird's fame has always been international and will last as long as man sails the seas. The albatross has been popularly endowed with a great capacity for wisdom. Doubtless his sagacity has been exaggerated, though certainly no more than his wingspread. Of course the latter attribute is unquestionably the most impressive thing of its kind in all Nature, and if an albatross were to give a demonstration in your living room, he would certainly sweep the pictures off the wall. Nevertheless, Doctor Murphy feels that most observers have been too impressed and that eye-measurements shrink under the tape. Eleven and a half feet is as far as he is willing to go. Big enough, you say. Yes, but the modern royal and the wandering albatrosses are only half the men their daddy was. The fossil ancestor, now unhappily extinct, was just about twice that size. Incidentally, it might be said here that albatross avoirdupois falls far short of the wingspread so that the Ancient Mariner probably suffered no undue muscular strain on his neck. At most he toted a mere fifteen pounds or so.

One gathers from the punishment meted out in Coleridge's poem that superstition operated toward the conservation of the species. But, however profound may have been the seafarer's dread of burning witch's oils and "throats unslaked, with black lips baked," it did not prevent those who manned the windjammers around Cape Horn from fishing for albatrosses. With salt pork for bait these hearties hooked the bill of many a bird of good omen, hauled him on deck, and made short work of him. Albatross plumage yielded feather rugs. The webbing of their feet supplied tobacco pouches, and their long, tubular bones made excellent pipe stems. The flesh, described as "sweet but not firm," was, of course, consigned to the cook's galley.

Among other engaging oddments concerning these prophets of the deep is the fact that, with supreme nonchalance, they preen their feathers and even scratch their heads while flying into the teeth of a howling gale. They can fly astonishing distances and still find their way back to the proper nesting grounds, although one particular, and ornithologically immortal, albatross was blown off his course and wound up in a gannet colony where he remained, among complete biological strangers, for a period of 34 years. He was apparently hospitably received by the gannets, though how far that hospitality extended during the mating season is unfortunately not recorded.

Expeditions

The same year that Murphy cruised southward on the brig *Daisy*, found Mr. and Mrs. Rollo H. Beck leaving San Francisco on the first leg of the Brewster-Sanford Expedition to collect birds of the sea and shore throughout South and Central America and the Antilles. The couple did not return to the United States for five years. During the interim these intrepid field workers collected, often at the risk of life and limb, the greatest assortment of marine birds from those regions ever brought together in one museum. It was not until the Brewster-Sanford collection came in from the field that scientists began to suspect sea birds of dwelling in a world apart. As the collection was sorted and catalogued, it became apparent that a new and distinct ornithological vein had been opened and that a special worker was needed to follow its course. Murphy, his natural feeling for the subject whetted by the whaling venture, was an obvious choice. He became the Museum's first Curator of Oceanic Birds.

Vast though this collection was, it could scarcely be considered complete, and Murphy was soon at sea again, bound for the Peruvian coast, where he investigated the remarkable guano birds discussed in his article last month. After four years spent working up his new collections and fitting them into the Brewster-Sanford series, he combed the northernmost parts of Ecuador and, in 1924-25, its Pacific coastline. These expeditions rounded out the field work prerequisite to writing his *Oceanic Birds of South America*, that monumental two-volume work which stands today as the latest word on the subject.

Perhaps more than any other man, Doctor Murphy has made us see that the ocean is emphatically not one vast undifferentiated desert waste. If all its many types of water were distinctly colored, we would see currents, layers and strata running in and out of each other in a most perplexing, almost surrealistic manner. But it is the surface water, and in particular the surface water surrounding South America, with which he is chiefly concerned.

South America is the world's wettest continent, being drained by a surprisingly intricate network of rivers which carry a wealth of minerals down into the encircling sea. Drawing upon the inland soil, these coastal waters produce a liquid medium favorable to the growth of an organic life, consisting mainly of algae and unicellular animals, which comes into being directly or indirectly through the photosynthetic action of the sun's rays. These invisible mites ("the insects of the sea") furnish food for slightly more complex animals, which are devoured by small fish and other water creatures, which in turn fall prey to the birds.

Oceanic ecology is, therefore, a neat summing up of land ecology, simplified by virtue of the smaller number of interrelationships involved. The biologist specializing in land creatures is often forced by the sheer mass and complexity of his material to concentrate on an unstartling though important minor relationship within the huge framework of the whole. Meanwhile, Murphy can embrace the shores, seas, and waterways of an entire continent. Owing to an extraordinarily lucid literary style and the natural tendency of his subject matter to fall into clear-cut categories, he can grip the imagination and teach us a great deal about how things work in Nature. For if you have mastered the fundamentals of the oceanic way of life, you are well on the road to an understanding of the general pattern of biological existence.

Adaptation and environment

The various currents which wind invisibly through the sea, differ markedly in temperature, among other things; and since lower organisms generally have very little resistance to changes in temperature, each current supports its own peculiar range of life. Naturally, when this base of the ecological pyramid varies, the entire superstructure must also vary. Thus, particular species of marine birds rely for their subsistence on particular oceanic currents and will follow those currents wherever they lead, no matter how far that may be from their original breeding grounds. And to venture outside that current means death. It need not be elaborated here, but the reader can perceive that this situation is affected by winds, rainfall, coastal mountain ranges, and all other meteorological factors. The main point—and Murphy's chief contribution to science—is that he demonstrated once and for all that birds of the sea are truly marine fauna having no connection with the land, except seasonally as a breeding place, and that they are as native to the open water in all other respects as the fish they eat.

Murphy's own colorful phrase, oft quoted, may bear repetition here. He describes the birds as bound like peons to their own special type of surface water. Of the 183 species studied in the course of his quarter-century of inquiry, not all are strictly sea birds. They are divided for purposes of classification into in-shore, off-shore and pelagic, each term locating the progressive distance from land. The fundamental principle, nevertheless, holds true. Each bird is a fisherman and each one specializes in a particular set of sea creatures inhabiting a particular type of surface water, and each is an instrument designed for the purpose.

In short, the oceanic birds of South America represent 183 different ways of dealing with particular phases of the essential environment which begins with sunlight acting on the leached mineral deposits of the land. Every organ and attribute of each one of the species results from the shaping, through centuries of selection, of organic material designed for a special task. Life in or near the bounding deep has developed some of the most efficient wings known to Nature, such as those of the booby[1] (who can catch a flying fish in mid-air), the frigate bird[2], and the albatross. It has also developed some of the least efficient. A number of its creatures have astonishing powers of vision. Others are woefully nearsighted. Some are excellent swimmers. Others would drown if they dropped accidentally into the element that furnishes their livelihood. And so it goes.

Compare the penguin with the albatross sketched above. He cannot fly a stroke. Nature made him, instead, a heavy, well-insulated torpedo, whose myopic eyes would be useless to the high-soaring albatross but which are nevertheless excellent for catching fish not only under water but under ice as well.

Like the royal and wandering albatrosses, the emperor penguin holds a world's record. He easily outweighs all other sea birds, sometimes topping 90 lbs. But his fame does not rest on this alone, for he is the most human of our feathered friends and is the basis of the stylized cartoon penguin known to everybody. For many years now he has been the subject of jokes about formal dinner jackets. He smokes cigarettes on the advertising pages of our magazines and has well-nigh superseded the Eskimo's igloo as a symbol of extreme cold.* It is true that he marches about on two legs just as we do, but not always. In fact, he moves faster on all fours and, if really pressed, will propel himself over the ice using web feet and seal-like flippers. Yet his generally upright posture and his nearsighted affability toward human visitors make it easy to forgive Anatole France's good Saint Maël, who was slightly snow-blind at the time, for his error in baptising the penguins. The birds so interested the satirical author of *Penguin Island* that he once remarked that, whatever his interests might seem to others, his sole aim in life was to investigate the ways of penguins.

And certainly they merit the attention of our most competent observers, for despite their immense popularity and their prominence in the symbolism, folklore, and literature of many lands, very little is known about their way of life. Doctor Murphy hopes the future will see a whole covey of ornithologists loosed on the widely distributed kingdom of the penguins in order to study their social organization and habits which, from the little that has already been verified, seem both highly complex and extraordinarily delightful.

As in the case of the albatross, man has overestimated the penguin's wisdom. He doesn't seem very bright and indeed lacks the cerebral development to cope with any really intricate problems. Of course, he can be taught, and in spite of a natural inclination calmly to ignore mankind, soon learns to flee in consternation after his indifference has resulted in a few massacres. There is, however, no way for this conditioned response to achieve the rank of species behavior. Yet they so resemble man that in our fulsome conceit we will probably go on attributing our capacities to them. And the charm of the penguins will certainly remain. Generations of sailors and naturalists have delighted in watching them go belly-whopping in the snow on their portly white shirt-fronts which, incidentally, are believed to be less conductive than the black feathers and hence keep the bird warmer—scarcely one of the recommendations of our draughty boiled shirt. Like some mammals, penguins sleep either upright or lying down. And it may be that they actually swallow pebbles for ballast! Since they lack gizzards, no better functional explanation has yet been offered.

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[1] From the Spanish *el bobo* meaning a dunce. Hence our use of "boob" for similar individuals.

[2] See "Man-o'-War," by Robert Cushman Murphy, NATURAL HISTORY, October 1939, p. 133.

*Though the penguin symbolizes the icy fastness of the Antarctic, only 2 of the 17 species (the emperor and the adélie) breed exclusively within the Antarctic Circle and the general tendency seems to be to get away from it. One species of these flightless birds even prefers the equator! Its presence there is due to the extreme northward penetration of the cool Humboldt Current, which carries food, suitable for penguin diet, up to the Galápagos Islands.

Pebbles, in fact, are quite important in their social life. Many penguins have an instinctive urge to cuddle eggs—anybody's eggs—in a crevice formed by their webbed feet and under-bellies. If no eggs are available, pebbles or rather smooth stones will do, or even suitably shaped chunks of ice. But it is in the courtship proceedings that pebbles become indispensable. Penguins, in common with many other birds and animals, cannot distinguish between the sexes and must select a mate by trial and error. However, "birds in general," Murphy writes, "seem to be more dependent than mammals upon a fixed order of reaction leading toward any essential physiological function."* Accordingly, the male penguin must find a way to his lady's heart by a series of devious maneuvers which become all the more necessary since he is, as often as not, in somewhat the same predicament as the suitors of Charley's Aunt. Staring out of his myopic eyes at another of his kind, of unknown sex, he finds a pebble and solemnly places it as an offering at her (his) feet. The astonishing thing is that the pebble sequence seems to have gone the way of our own more elaborate rituals. So much so that the stone has become purely symbolical. It is quite subordinate to the gesture itself, and the penguin suitor may simply go through the motions and place and an *imaginary* pebble at the other bird's feet. The latter may show indifference (in which case it is at best an unresponsive female) or fight (in which case it is probably, but not certainly a male). One really feels sorry for these victims of gonadal secretion attempting to respond obediently to Nature's demands under such confusing circumstances.

There is an unemployment problem among penguins which serves to further their resemblance to ourselves. These semi-outcasts are, however, not victims of capitalism's notorious cycles. They fully participate as rugged individualists in penguin economy, which consists largely of gobbling up squid and similar cephalopods, their unemployment being of a social rather than an economic nature. The unemployed are "bachelors," which term when applied to penguins, includes both sexes. Some writers call them "rogue penguins," others "hooligans," which should give some idea of their disruptive influence on their happily married brothers and sisters. Apparently they are always lurking about, ready to kidnap somebody's egg or chick, and more than anxious to fight a pitched battle for the privilege of cuddling same. Although this survival mechanism assures the proper asylum for the community's orphans in a bitterly cold climate, it has been so elaborated that chicks not infrequently freeze to death while two perfectly strange adults, one or both of which may be rogues, battle for its possession.

Penguins are terrific fighters, particularly during the brooding season. This propensity has given rise to one curious and highly amusing custom among king penguins for which no one has yet ventured an explanation. The idea more or less resembles the lowest comedy act still extant on our stage and screen—the bathetic slapfest. The birds gather in the form of a circle, each cuddling an egg, and go to sleep standing up. One of them awakes and, unaccountably, rouses his neighbor with a resounding belt of his flipper. The latter retaliates with a whacking "back-hand" and instantly the entire circle is transformed into a Donneybrook Fair—shillalahs, in the shape of lean blue flippers, clouting in all directions. Then the free-for-all subsides as suddenly as it started. The penguins remain stationary throughout, seldom losing hold of their cherished eggs, and go back to sleep again, apparently the best of friends.

Champion of them all is the em-

Continued on page 64

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*With the albatross it is good form to bow elaborately during courtship. If a man venturing among them at this time bows to an albatross, he stands a good chance of having the compliment returned.

INFORMATION TEST

A few informational high spots that may be gleaned from this month's NATURAL HISTORY

Correct answers on page 64.

1. What two insects has man domesticated?

2. What gesture could you make to an albatross during the courtship season and expect to have the bird return it?

3. It was used as a bullet against British troops in India; when worn around the neck it keeps off thunder; and it is of special interest to persons born in January. What is its name?

4. A soldier has three pets: a canary, a cat, and a turtle. Which would stand the best chance of surviving a gas attack?

5. Penguins are conspicuous among birds for their excellent vision and can distinguish their mates even when they are mere specks in the sky.

True........ False........

6. Ants are sometimes gem-miners.

True........ False........

7. The greatest wingspread in the world belongs to

(a) The albatross

(b) The eagle

(c) The ostrich

8. One of the following is known to have lived from 1766 to 1918; check which:

(a) A Sioux Chief

(b) A tortoise

(c) A penguin

9. What island within 21 miles of North America and two and a half times as large as the State of Rhode Island has been privately owned for 260 years?

10. It came into being largely because of a single animal; it promoted human understanding; and it may be called the Indian's greatest invention. What is it?

YOUR NEW BOOKS

LIFE ON OTHER WORLDS ● AFRICA ● HISTORY OF JEWELRY
BIRDS ● RACE AND RACISM ● WHY MEN BEHAVE LIKE APES
WATERHENS ● PLANS FOR GARDENS ● MICROSCOPIC WORLD

RACE: Science and Politics

by Ruth Benedict

Modern Age, $2.50

WE hear much about race these days—most of it extraordinarily ill-founded and ill-informed. The common conceptions in pre-Hitlerian times were confused enough but in the last decade they have become worse compounded. Even the most manifest absurdities and contradictions by dint of frequent repetitions gain some credence and the voices of professional anthropologists raised against them become smothered in the avalanche of ever more incredible variations on the racial theme. Myth-making enjoys a greater popularity than myth-breaking.

In this closely written, admirably reasoned book Professor Ruth Benedict takes race and racism apart, examines whatever scientific basis they possess, re-creates their history and explains their vogue in terms of social, economic and cultural patterns. Her significant contribution is the sharp distinction she draws between race and racism. Race is a legitimate field of investigation about which some things are known — precious few — and many unknown. Racism is a dogma developed by a number of non-scientific and inspirational writers in response to social, economic and political conflicts. The fallacy lies in supposing that the scientific body of knowledge about race supports racism. It doesn't. Racism is an intolerance, a shibboleth of the times which has been made a convenient tool for more basic struggles. In a modern guise it is the old intolerance of the in-group for the out-group. But in this age of science it follows contemporary patterns by adopting a pseudo-scientific learning. Every manufacturer with a line to advertise knows that one.

This book should be read, it should be digested, and its truths should strengthen our democratic faith.

H. L. S.

5000 YEARS OF GEMS AND JEWELRY

by Frances Rogers and Alice Beard

Stokes, $2.50

THE reviewer knows of no new books on jewelry as distinct from gems, since the death of Doctor Kunz, so this work on the history of jewelry making and wearing through the ages has a place unfilled by other gem books. The authors have previously published works on glass and communications and water and now turn their attention to another subject which they feel appropriate to a popular treatment. The book begins with the first glimmerings of prehistoric man's interest in pretty pebbles, carries on through Egypt, Greece and Rome, medieval and Renaissance Europe, and spreads out in chapters on seventeenth, eighteenth and nineteenth century jewelry. There are many myths and anecdotes retold here that make it interesting reading. Another chapter tells of the development of jewelry in the United States and traces the history of two of the better-known gem dealers. In the course of this recital something is told of the technical aspects of jewelry manufacture as it is practiced today. Cutting forms, synthetics, imitations and doublets are described.

The third section deals briefly with the gem stones themselves. The book is illustrated with many pen and ink sketches, and halftone plates, many of them of objects in the Metropolitan Museum. They are only there as cake frosting, however, for there are few references to the illustrations in the text.

It might be suspected that the authors of books on such diverse subjects are only assembling information published elsewhere and rewriting it in an interesting and readable fashion giving a novel atmosphere and approach to the subject. If this is so, then it is well and interestingly done. However, there is little new information and the third section contains a number of mistakes. The remainder is very acceptable as a handy, brief and interesting history of jewelry making and wearing through the ages.

F. H. Pough.

BEYOND THE SMOKE THAT THUNDERS

by Lucy Pope Cullen

Oxford, $3.00

EARLY in this century a rich deposit of copper ore was discovered far up in Northern Rhodesia. Only twelve years ago its exploitation began. Just as he came upon the outcrop, the first prospector had shot a pine buck, so the mine became known as the Roan Antelope. If you want to know the devious way by which the copper was located, what life is like in a new African mining camp, and lots of strange facts about Rhodesia, read Mrs. Cullen's book.

She spent six years at the mine, and kept open eyes on everything around her. The strange behavior of white people and black, especially native servants, is discussed with humor and understanding. The animal of the bush, and those kept alive as pets, are described most sympathetically. Think of trusting the judgment of a tame monkey as to mushrooms safe to eat! The "turkey buzzard" of southern Africa is, of course, a ground hornbill, which can become a most amusing dooryard fowl.

The "Smoke that Thunders" is Victoria Falls, north of which Mrs. Cullen spent most of her time. But from Southern Rhodesia, too, she gives a splendid account of a private game reserve belonging to the extraordinary Mr. Robins. Would that Africa had more like him, and that his original method of warning elephants to depart were more widely used!

Even a naturalist who knows Africa will read this volume with pleasure and profit. But it should appeal most of all to housewives who think they would enjoy life in the wilds and to secretaries who have dreamed of marrying the boss in some faraway bonanza.

James P. Chapin.

THIS LIVING WORLD

by C. C. Clark and R. H. Hall

McGraw-Hill, $3.25

WHEN is a textbook not a textbook? It rarely happens that a textbook is so planned, written and illustrated that it bridges the wide gap which exists between a textbook and popular nonfiction. This book was written as a text for a college course in science. Along with its companion volume, *This Physical World,* now in preparation, it will fill the need for good textual reading for the newer type of college course on science for nonscience students. A study of this book proves it to be very suitable reading for anyone interested in obtaining a good introduction to the world of science.

One senses that the authors have tried to do something different. The easy, fast-moving narrative style of writing combined with accuracy of data and a wealth of illustration makes the book a delight both to eye and mind. This book is an attempt to "present in a form which combines accuracy with pleasant reading, the gist of modern knowledge about the living world, with special reference to the physical development of man and the structure and functioning of his body." The authors have been successful in attaining this end.

Beginning with a discussion of the physical environment which supports life and the general characteristics of living things, the authors continue with an account of the development of life in the geologic past. Then there follows a treatment of the complex physical organization and functioning of the human body. Here is a book on the science of life written for man which places the accent quite correctly on man himself. Wherever possible the authors have been wise enough to introduce the different topics by first referring to common knowledge and then proceeding to material not so generally understood. Anticipating the possibility of the desire of certain readers to delve more deeply into the mysteries of life, the authors have added excellent annotated lists of references at the end of each chapter.

The authors are to be complimented on their timely choice of illustrative material. The photographs are, for the most part, new and very aptly suited to the text. The excellent drawings and charts by Louise Waller Germann leave nothing to be desired. All in all, *This Living World* does complete justice to its title. It has no new contributions to make to the science of life, but the authors have succeeded in their plan, namely, to make the science of the living world a living thing for the layman.

JOHN R. SAUNDERS.

THE MICROSCOPIC WORLD

- - - - - - - - - - by Frank Thone

Messner, $3.00

DOCTOR THONE has written a very readable and interesting survey of the teeming community of invisibly small organisms which permeate all of our environment. The material is well balanced and organized so as to give the reader a reasonably comprehensive picture of a vast section of the living world. The strange facts, curious animals and plants described here should indeed stimulate almost anyone to delve further into the lives of our unseen neighbors whose activities have at times so profound an effect upon our own lives.

The first chapter discusses the microscope itself, the window through which we must look to examine the microcosmos, the second a brief history of the subject, the third a general review of the microscopic animals and plants with some excellent definitions of terms. From the third through the twenty-first, each chapter is devoted to the exposition of some particular aspect of microbiology. The twenty-second and last deals with recent advances and research now in progress. This is in some respects the weakest chapter in the book as it is largely devoted to a single piece of work, Doctor Regnier's attempts to produce germ-free guinea-pigs. However, as the author writes, "So extensive are the various fields and so numerous the research workers in them that it is obviously impossible to give in so limited a space a comprehensive picture of original investigations now going on in microbiology."

The book is illustrated by numerous photographs, including a number of microphotographs, which range through the whole gamut of quality from the excellent as Doctor Roemmert's of a heliozoan on page 124 to the downright bad as the yeast cells on page 172. It also seems a bit misleading that some of the photographs which picture enlarged glass models rather than the actual organism are not so indicated.

JOHN C. ARMSTRONG.

WHY MEN BEHAVE LIKE APES AND VICE VERSA

- - - - - by Earnest Albert Hooton

Princeton University Press, $3.00

AMERICAN anthropology has been considerably enlivened in recent years by a series of books from the witty pen of Professor Hooton, who has never hesitated to be humorous where dull solemnity might have served.

The present work is devoted to the thesis that behavior and organic structure are intimately correlated. No claim is specifically made that behavior is causally linked with variations in anatomy, but rather that they are "co-terminous." If I understand correctly, this means that the organism tends to acquire special behavioristic patterns more or less simultaneously with anatomic deviations. Thus behavior and structure evolve *pari passu* but independently. There are, however, hints that Hooton is prepared to go further in linking body and mind.

The field which Hooton surveys for evidences of his contention begins with the primates, passes through the various stages in the evolution of man, embraces the modern human races, and ends with a consideration of the individual. In this last, he presents a masterly summary of Sheldon's technique for the classification of variations in body build.

Interwoven contrapuntally with this major theme runs a secondary one which has appeared in former books. Society is only as good as the population that comprises it. To neglect the biological heritage of the nation, to fail in preserving and improving its quality, to resort to sociological panaceas instead of selective breeding spells doom for the nation. As part of a concerted research for the understanding and improvement of society, Hooton envisages the study of behavior and structure as an important foundation stone.

H. L. SHAPIRO.

THE BOOK OF GARDEN IMPROVEMENTS

- - - - - - - - - - by Walter Brent

Chemical Publishing Company, $2.50

MOST books that are written on the subject of gardening give instructions for planning and building. This new one, *The Book of Garden Improvements—Over 1000 Ideas and Plans for Amateur Gardeners*, reverses that procedure by giving detailed plans whereby the old garden can be enhanced by remodeling.

The author, an Englishman, has also indulged many times in the giving of advice to builders of gardens. He has written a number of books and for years has edited garden magazines. It was the author's custom, whenever possible, to travel about the English countryside so that he might discuss gardening problems with their various owners. Since the more frequent questions which were asked him had to do with the improvement of gardens already established, he decided to write this book as an answer to such inquiries.

Even though the English gardens are under consideration here no doubt gardens, whether English or American, look just as uninviting if the pergola has no reason for being, the walk be too puny for the size of the garden, or a plant which was intended for a three-foot space grows to a seventeen-foot size. Undoubtedly many of the suggested plants are species that respond best to English climate and many Americans may have difficulty in reckoning the cost of building materials since these are estimated in so many pounds and shillings instead of dollars and cents. But the rules given for making, say, an ornamental wall, trimming a hedge, making a flagstone walk, sunken pond, attractive fence, pergola, trellis or gate, will not vary much whether it be for this area or for areas abroad.

The suggestions given are very definite, such as, "The minimum width for a turf edging is 12 in.; if narrower you can't mow it with the lawn mower," or, "no path should be narrower than 2 ft. 6 in.; otherwise it tends to lose all meaning as a path; it looks like a track!"

The book is profusely illustrated with line drawings, black and white photographs (which are not too clear at times), fifteen color illustrations (of the seed catalogue type) which are rather effective in showing formal garden designs. In fact, if you have become tired of your garden you may find help here among the many hints given for the improvement of nooks, retreats and vistas which do not satisfy your artistic sensibilities.

FARIDA A. WILEY.

THE ROCK BOOK

- - - by Carroll Lane Fenton and Mildred Adams Fenton

Doubleday, Doran, $6.00

THE geological account contained in *Our Amazing Earth* written by Doctor Fenton two years ago is supplemented by this latest work on more restricted aspects of the science. First the building particles, the minerals, are discussed. Some of the more important ones are described, the uses and best known occurrences listed. From the minerals, the authors then go to the processes by which rocks are formed, beginning with the igneous rocks and the various types of igneous bodies, making their descriptions clearer and easier by means of the minerals which have already been described.

This same process is followed in preparing the way for the sedimentary rocks, the manner of their formation and the various kinds of sediments, and resultant rocks, then the metamorphic processes and the metamorphic rocks. It leads to a clear and good understanding of the principal geological processes, the structures of the earth's crust and the processes by which they were made.

A fine popular bibliography and collection-suggestions conclude the book. The plates are excellent and the color plates of minerals, of which they are a disproportionate number, are probably the best that have been published so far. A few rock pictures in color would have rounded out the illustrations and have given the hasty "thumber-througher" a truer picture of the contents.

The mineral chapter is by far the poorest section. It is often inaccurate and misleading in its statements and few minerals have completely correct descriptions. To quote some of the more glaring errors: in speaking of spodumene, Doctor Fenton says, "a green variety *(kunzite)* is found in California." [Kunzite is pink—hiddenite, the green variety, is found in North Carolina.] "Emeralds come mainly from Brazil, Ceylon, Hindustan and Colombia, a few have been found in North Carolina and Colorado." [None are found in Ceylon, Hindustan or Colorado; Colombia, Africa and Russia are the important localities.] After saying that "most collectors cannot distinguish [orthoclase and microcline] unless the microline is a bluish green . . ." the author pictures microcline crystals in Plate 8 and labels them orthoclase.

There are also many misleading statements on mineral sizes, listings of exact crystal dimensions of some particular specimen under many minerals, taking the place of a statement of the general range, and implying that it is unique, rather than an average for the occurrence. The remainder of the book is far better. It is unfortunate that these minor, but important, mistakes were not corrected before publication, as they so easily could have been had the manuscript been read by a mineralogist at that time.

F. H. POUGH.

PREFACE TO EUGENICS

- - - - - - - by Frederick Osborn

Harper, $2.75

EUGENICS is one of those words that belong well up in Mr. Stuart Chase's semantic series, among those phrases whose emotional overtones obscure their fundamental meaning. After reading Mr. Osborn's well-balanced and persuasive introductory chapters in his *Preface to Eugenics* which deal with the interrelations of birth rate, heredity and environment in shaping the present and future character of our population, any lingering doubt on the wisdom of a sane eugenic policy must inevitably vanish.

Scientists, like other human beings, are prone to exaggerate, especially if they feel that they have a message that other members of their co-fraternity are too blind or too dull to see. Consequently we have been deluged on the one hand with minatory literature intended to awaken horrid fears that our biological heritage is rapidly degenerating and, on the other, with assurances that everything will be all right as long as some special environmental reform is adopted. For the most part eugenists have fallen into the former category. Mr. Osborn, however, has eschewed either extreme. He has calmly assayed the most significant research on the subject and has arrived at the conviction that both nature and nurture require consideration in a sound population program. In this common-sense view he occupies a most uncommon position and to my mind the only tenable one.

But Mr. Osborn is not content with merely pointing out the nature of the problem confronting us. He offers a carefully considered program adapted to the social and psychological conditions peculiar to the United States. In fact, he is decidedly optimistic that existing social agencies can easily be developed into an effective mechanism for the improvement of our population.

Preface to Eugenics represents the mature thought of a profound student, without being difficult to read. It will, of course, be on the list of everyone seriously interested in the welfare of our population. But it is more important that those who have distrusted eugenics read it.

H. L. SHAPIRO.

JOHN AND WILLIAM BARTRAM

- - - - - - - by Ernest Earnest

University of Pennsylvania Press, $2.00

IN company with the increasing interest in the influences which have led to our present American pattern of life is this absorbing biography of the Bartrams, father and son, botanists and men of letters. It is an analysis of the background of eighteenth century Philadelphia which made possible the scientific and scholarly pursuits of these men and of the influence which they had upon subsequent life and letters. Through his explorations of the eastern United States and collections of new plants from colonial America, the father, John, not only increased knowledge of the plants of this continent but completely altered the fashion in gardens. Both father and son wrote of their travels, but the latter, with more romantic imagery, had a more important influence upon literature, notably that of Coleridge and Wordsworth.

For a most interesting picture of the small world of the eighteenth century, in which almost all the important men, both in Europe and colonial America, knew each other, this is recommended reading.

J. W. THOMSON, JR.

A WATERHEN'S WORLDS

- - - - - - - - by Eliot Howard

Cambridge University Press, $2.50

THE waterhens *(Gallinula chloropus)* of which Mr. Howard writes are his near neighbors. For 29 of 30 years their kind has occupied a third of an acre pond beside his English home. Given the opportunities offered by this intimate association, it follows that Mr. Howard has penetrated far into what he calls the "waterhen's worlds." In this volume he presents the results of his studies of the worlds of sex. Beginning early in February, when the birds become sex-conscious, he follows the development of their family life from the first evidence of courtship to the dismissal of the young.

The worlds of territory, of sex, with the platform as a stage for its manifestations, of the nest and eggs, of incubation and treatment of the young are reviewed with sympathetic insight and made real by George Lodge's fine drawings. The bird's delicately adjusted activities are sensed with perceptions so keen one might well believe that through prolonged association Mr. Howard had become a waterhen!

In the four opening chapters it is shown that the phenomena of the nesting season, while largely the outward manifestation of changing inward conditions, may also be governed by environmental associations. Thus with the laying of the eggs and beginning of incubation there is a cessation of sexual intercourse, and dissection would have shown an accompanying decrease in gonadial activity. But there was a male who, during the absence of his mate, resisted the advances of a strange female as long as he remained in home territory with which his wife was associated. He yielded, however, to the intruder when they met in other surroundings, thus indicating that he was influenced by external rather than internal conditions.

In the final, or explanatory, chapter, entitled "The Becoming," the speculative psychologist seeks his way through waterhen worlds unknown even to waterhens and where we are soon lost in a maze of cryptic philosophy.

F. M. C.

WINGS AT MY WINDOW

- - - - - - by Ada Clapham Govan

Macmillan, $2.50

CHANGING the gender and the century, Mrs. Govan is a modern St. Francis of the Birds. She does not preach to them: she lets them preach to her. Out of illness and sorrow her birds led her to health and happiness.

This book is for bird lovers, whether amateur or professional. It is also full of human interest; people who start it not knowing a robin from an oriole, won't lay it down. It combines the power of a soul to conquer against odds, with the incomparable power of the birds to cure. And it adds for good measure original data of how to attract, feed, and care for birds around one's home. No professional conservationist could write a more winning or a better informed plea for bird protection. Mrs. Govan in her simplicity, her affectionate humor and her vitality, can herself hardly realize the value of her work. First, she learned to bring the birds to herself. Now, her book will bring others to the birds.

Beside her home, she counts 300 fox sparrows, and once 164 evening grosbeaks. She supplies 290 pounds of birdseed in four months. She cuts yarn for nests so generously that 700 pieces are flown off with in one morning. She watches the courtship of the purple finch. Her birdbanding ventures make good records as well as good descriptions of how to handle trapped birds. Her imaginative references to birds' facial expressions run away with her for a bit, for, while birds can erect the feathers on various parts of their heads, they are incapable of facial expression as we know it in man or dog.

Dorothy Bayley's drawings are on a par with the charm of the whole book.

GRACE E. BARSTOW MURPHY.

LIFE ON OTHER WORLDS

- - - - - - - - by H. Spencer Jones

Macmillan, $3.00

ARE there inhabitants on Mars? What is the probability of life on Venus? Of the thousands of questions asked by visitors to the Hayden Planetarium these are among the most numerous. It is a natural curiosity that inspires such inquiries, and members of the Planetarium staff make every effort to provide answers whenever possible.

Life On Other Worlds, by H. Spencer Jones, Astronomer Royal of England, offers Mr. John Q. Public the most comprehensive and intelligent discussion of this problem that we have yet discovered. As a scientist of high standing among his contemporaries, Doctor Jones tackles the problem in a most logical manner. After painting a word picture of the universe as it is known today, he reviews the conditions necessary for life as we know it on the earth. He discusses the methods by which the modern astronomer studies the planets and tells in detail what is known of the physical conditions on these neighbor worlds.

He explains that Venus may be in a condition somewhat similar to the earth many hundreds of millions of years ago. This planet may some day see the development and evolution of life as it has evolved here. As for Mars, he suggests that some forms of plant life may exist there. Aside from these planets, he argues that life as we know it cannot exist elsewhere in the solar system.

Life On Other Worlds provides lively reading and can be relied upon as the last word on a question that is of interest to scientist and layman alike.

Robert R. Coles.

THE TETRAPOD REPTILES OF CEYLON

- - - - - - by P. E. P. Deraniyagala

Colombo, Ceylon: Colombo Museum, Rs. 10/-. London: Dulau & Co., Ltd. 15/-.

THE first volume of this comprehensive treatise constitutes the fourth volume of the Colombo Museum Monographs on the Zoology of Ceylon, and is published by the Government of Ceylon. It deals with the testudinates and crocodilians, while the second half of the work will be devoted to the lizard-like forms, including the limbless skinks which "although not literally tetrapodal, retain vestiges of the limb girdles." It is provided with a systematic arrangement of the Ceylon reptiles with which the author deals, a glossary of scientific terms, indexes of native, English and scientific names and a nine-page bibliography. Each species is described in considerable detail, attention being given to osteology, ontogeny and habits. Thus it is not only a valuable reference work for the specialist, but instructive reading for the amateur. The 412 pages of text are generously interspersed with drawings and photographs by the author.

AMERICAN WILD FLOWERS

- - - - - - - by Cecile H. Matschat

Random House, $0.50

NINETEEN of the 264 familiar color plates which orginally were issued in *Wild Flowers of New York,* and later appeared in *Wild Flowers,* are used in this slender volume which is designed to stimulate the juvenile interest in wild flowers. A number of additional species are pictured on the end papers, together with brief comments upon them. The text accompanying the color plates is interesting and written on a juvenile level; the scientific names are relegated to the table of the season of bloom at the end of the book.

J. W. T., Jr.

ULTIMA THULE: Further Mysteries of the Arctic

- - - - - by Vilhjalmur Stefansson

Macmillan, $3.50

FOR anyone familiar with Stefansson's published writings of the last three years, this volume comes as a logical sequel. He has such a faculty for accumulating and marshaling facts and data that the research on his preceeding work on Iceland must have yielded him more material than could justifiably be used.

Under the present title we have three main subdivisions. The first, "Pythias and Ultima Thule," reviews all the pertinent facts and suppositions showing whether Pythias the Greek did or did not visit Iceland in the fourth century B.C. As far as the average reader, unfamiliar with the pros and cons of this scholarly problem, can discern, he has exhausted all of the real and supposed aspects of the case. Although Mr. Stefansson offers no very positive answer to this ancient question, there is little doubt as to his own convictions.

The second section, titled "Did Columbus Visit Thule?" is probably of more general interest, for many people must have heard some previous reference to this scantily documented trip to Iceland. Long a controversial question, he has reviewed its historical background, the data on which it was founded, and the attitude of various writers since the death of Columbus. Included is a previously unpublished contribution toward the solution of this problem, Miss Eloise McCaskill's retranslation of the original reference, and her study of a map made by one of Columbus' shipmates. Again, although the reader is challenged to form his own conclusions, there is no doubt as to the author's convictions.

The third part, "Were Pythias and Columbus Right about Arctic Climate?" is a chronological presentation of man's conception of Arctic weather. To most of us, it may be a surprise to learn that there are some observers who maintain that there is no summer season in the Arctic. The reviewer believes that Stefansson has taken these too literally and in his refutation has gone to the other extreme. As he himself hints, the truth is hard to generalize about.

Junius Bird.

Ultima Thule

by Vilhjalmur Stefansson

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IN his many trips of exploration into every country of the world, Doctor Andrews has picked up curious items about animals, about puzzling happenings, about popular misconceptions, and about scientific discoveries. Now for the first time these have been brought together between covers, in response to an overwhelming demand.

The subject matter covers a wide range, from wild ducks and gorillas to the domestic cat, concerning which readers of Natural History have already had a sample in Doctor Andrews' engaging story of "Lord Jitters," published in last month's issue of the Magazine.

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G. P. PUTNAM'S SONS, New York

THE IMMIGRANT IN AMERICAN HISTORY

- - - - - - by Marcus Lee Hansen

Harvard University Press, $2.50

THE varieties of snobbery are infinite, but while some are universal others flourish only under special circumstances. In all colonial areas the first settlers take on the pride of priority, but in America this form of snobbery has assumed fantastic and often ludicrous proportions. Perhaps nowhere in the modern world has so complex and sustained an immigration inundated a comparable area as in America; and consequently hierarchies within hierarches of great complexity have arisen, based on chronological succession in the settlement of the United States. Entire national groups by virtue of 20 or 30 years antecedence in reaching these shores have either assumed or had airs of superiority thrust upon them by a following wave of different origin. Those of colonial descent feel a subtle but pervasive superiority over all the immigrant stocks reaching America after the Revolution. The Irish and Germans who settled in the United States in the middle of the nineteenth century had to endure native prejudice, but in turn scorned the Hungarians, the Italians and the Poles who succeeded them. The Jews of pre-Revolutionary families, if they have not already been absorbed in the general population, consider themselves aristocrats, and the German Jews of the fifties rank themselves above their Polish and Russian cogeners of the eighties and nineties.

The ramifications of this mild form of national lunacy are too complex, however fascinating, for a brief review of a book which I have found to be an unqualified delight. I mention them only because a species of this attitude has blinded our professional historians to the part which the nineteenth century immigrant has played in American life and which Professor Hansen in this posthumous account of the immigrant in American history was one of the very few to perceive. In the nine chapters or essays which comprise the book, he has taken various aspects of this immigration and linked them to our common history. He has characterized the distinctive qualities of the migration from 1815 to 1914 as well as its community with the colonial immigration. He has drawn a composite picture of the hardships and trials encountered from the casting off of home ties until the establishment of new ones in the New World. The role of the immigrant in the westward expansion, his stabilizing of democracy in the critical years after the Revolution, his contributions to Puritanism by means of conformity and reaction, his gifts to American patterns of culture form topics for discussion. The wealth of material still awaiting patient research, which Professor Hansen outlines in a final chapter, is alone enough to whet one's appetite for a more complete treatment of a sadly neglected field.

I read this modest but illuminating book with a mounting pleasure. It has authority; but what is more, it has a profound significance.

H. L. SHAPIRO.

GEMSTONES

- - - - - - - G. F. Herbert Smith

Methuen, 18 *s*

THIS admirable text, the first edition of which appeared in 1912, has been a standard of popular reference since that year. Dr. Herbert Smith, however, has produced in this, the ninth edition, what amounts to a new and very much up-to-date book.

As the publishers point out in their prospectus, the scope of the rewritten text has been widened so that its appeal is no longer confined to that section of the public interested in a popular handbook on gems, but may also be used as an authoritive tool by professional gemologists throughout the English speaking world.

What impresses one chiefly is the masterly way in which the great mass of information about gems has been organized so that a given fact or group of facts may be readily found and correlated. The author has accomplished this without in any degree sacrificing the charming lucidity of diction which has characterized his book throughout its eight previous editions.

Such terms as "igmerald" (synthetic emerald produced by the I. G. Farbenindustrie) and "endoscope" (the microscope accessory used to differentiate native from cultured pearls) are fully discussed, and serve to indicate to what an extent *Gemstones* has been brought strictly up to date.

The new edition adds about 120 pages over previous ones, but owing to the difference in format and typography, it contains upward of 200,000 words over any previous one. New halftone plates have been added and substituted, and many new and better line cuts explain the letter press. It is unfortunate that the four color plates are not up to the standard of the British Museum postal cards in accuracy of color.

H. P. W.

JEWELS AND GEMS

- - by Lucile Saunders McDonald

Crowell, $2.00

THIS gem book is unusual in that it tells little about gems, but a great deal about jewels. Here is no dry, scientific discussion of the various gem stones, but rather a fascinating collection of stories, legends, and myths concerning jewels. Most of the emphasis of the book is placed upon the gems of the Orient, and some of the most vivid stories are those of Great Moguls of India, who must have been very disagreeable people.

The chapter headings, such as "Moonlit Dewdrops," "Thieves in the Garret," "Stone Trees, Kangaroos, and Opals," "The Ruby Kingdom," "Sun Stone and Desert Gem," "Isles of Riches" and so on, give a very inadequate idea of the content, but somewhere through the book most of the gem stones are mentioned, and there's usually an entertaining bit of story telling.

A tremendous amount of research into original sources went into the writing of this book and it would have been interesting if a list of references had been given. The chief criticism of the book is that the author, while well versed in the old literature, lacked the background of science which would have enabled her to distinguish between possible and impossible tales and, much more important, to know what gem was meant by the older writer. Gem terminology has been badly confused through ignorance and dishonest misrepresentation, and the unwary author can fall into a terminology trap, as Mrs. McDonald has done. Her chapter on topaz really describes a yellow sapphire, her "precious" amethyst is really violet sapphire, and so on. It is good reading, but the author is no authority on gem names or relationships. Remember that it is purely a story book, have an authoritative, if dry, gem reference handy, and enjoy yourself with this book.

F. H. POUGH.

LETTERS

Continued from page 4

SIRS:

. . . Your magazine is highly prized in our family by three generations of readers.

(MRS. U. N.) DONNA ISABEL BETHELL.
Upper Montclair, N. J.

* * *

SIRS:

. . . I enjoy your magazine very much and always look anxiously for the next number.

W. T. SHIPE, M.D.
Middletown, Ohio.

* * *

TO THE EDITOR OF UNNATURAL HISTORY:—

In your current number you feature an article on Eo Hippus. And what you don't do to NATURAL common sense let alone HISTORY.

And then your printing of Knight's "Resurrection of the Dawn Horse," Mirabile Pictu. Waly Disney should hire Knight for the second edition of *Fantasia.*

Dr. Weyer, if we dominies, who are supposed to walk around with our heads in the fog, allowed our imagination such wild range in theology, as the forementioned is in what is supposed to be science, we would be laughed out of any asylum.

I had long intended writing the Museum about their Hall of the Age of Man, and its paper mâché concoctions. Not that I have hopes for any mind who sponsors such nonsense as science: but simply because I shed a tear for the little children who are shown such wrongness.

Not that I expect, but to put one country parson on record as able to see how the Devil operates. I shall pray for you. Do you ever feel repentant?

Cheerfully and hopefully yours,

EDWIN I. STEARNS.
First Presbyterian Church,
Whippany, N. J.

CATCH A COMET

By Charles H. Coles

Chief Photographer, American Museum of Natural History

A COMET for New Year's Eve! How fine, thinks the astronomer, amateur or professional. Something new in the sky to watch. It has been 30 years since we saw a good, naked-eye comet. According to the laws of chance, we should have had one before this. Let us make a portrait of this celestial visitor.

Cunningham's Comet should be an interesting object in the sky, and if you search the heavens shortly after sunset around the beginning of the New Year, you will be able to see this luminous giant. Certainly here is an opportunity for those enthusiastic camera fans who thrive on unusual photographic stunts. Shooting such a celestial object is an interesting experiment, quite different from the usual run of picture taking.

Mounting the camera

Because a time exposure will be needed to record a relatively dim object such as a comet, special provision will have to be made to allow the camera to follow the movement of the stars. The heavens appear to revolve around a point in the sky which is a prolongation of the earth's axis of rotation. This point is quite near the Pole Star, actually only about one degree away, which is an inconsequential difference for the business at hand.

In order to make exposures of any duration of the sky, the camera must be set upon an axis that is parallel to the earth's axis and must rotate at the same speed but in the opposite direction. All this may sound very complicated, but actually it is quite simple if you can obtain a motion picture camera tripod with a pan-and-tilt head. The tripod is set up out-of-doors, in a place where the wind won't shake it, with one of its three legs on the north side of the tripod. The north side is, of course, the side toward the Pole Star.

Of course you remember how to find the North Star. Join the two end stars in the bowl of the Big Dipper with an imaginary line and carry it up five times this length until it hits the only bright star in that region of the sky.

Shorten the north leg of the tripod until the tripod head assumes an angle with the ground of 90° minus your latitude. For instance, New York has a latitude of 41°. 90 — 41 leaves 49, which is the angle the tripod head should make with the ground. Actually, 45° would be close enough for our purpose. This angle is easily obtained with a carpenter's level and a 45° triangle. This tilting down of the head of the tripod to the north makes the panorama axis (normally upright) point directly at the North Star. Note that we do not mean to point the camera at the North Star, but a line running straight through the center of the base to which we screw the camera.

Making the exposure

Screw the camera onto the tripod head and swing it to face the comet, using the sky chart on page 8 of this issue of Natural History. This may be something of a trick, with the tripod at such a rakish angle. In fact, it may be necessary to add a small ball-joint to the top of the pan-and-tilt head. If the tripod becomes unsteady, guy it with cord to a stake or two driven into the ground.

Some sort of magnifying sight will be necessary to guide the motion of the camera. A small telescope magnifying 15 or 20 times or a pair of binoculars fastened to the camera will be quite satisfactory.

The camera should be loaded with fast film, the lens diaphragm opened to its fullest extent, and the lens focused at infinity. You may be more comfortable while following the comet if you sit on a chair close to the tripod. When all is in readiness, look into the telescope or binoculars attached to the camera and watch the stars drift across the field of view in accord with the earth's rotation. The effect is much more noticeable at the edges of the field, because there the stars will be passing a stationary boundary.

When a sufficiently bright star comes into the field to be seen easily, wait until it is just about to leave the field of the binoculars or telescope and then open the camera lens. As it drifts out of the field of vision, move the tripod head ever so slowly until the star is brought back into the edge of the field again. When it drifts out, bring it back again with a slow movement of the panorama head. Keep the motion as even as possible by acting as soon as the star drifts out of sight and bring it just back in. Continue this procedure until the exposure time is up. Only the panorama axis need be rotated; the tilt axis must remain clamped.

Exposure of fifteen seconds to two minutes should prove ample with a lens of f:4.5 or larger, if the fastest film is used. Since it is impossible to determine accurately the time of exposure, it will be wise to make several shots, varying the exposure time with each try.

If it happens that the comet can be photographed only during twilight, infra-red film may solve the problem of an over-bright sky. Of course a red filter will then have to be used over the lens. In either case the film must be developed for about double the normal length of time to obtain maximum contrast.

A striking picture of the comet will be quite a souvenir to have of this celestial event. Try your luck at shooting this visitor from beyond as it dashes in for a whirl about the sun. It will vanish soon, perhaps forever, into the dark emptiness of space. Even if you don't get a good picture, your hardships while trying will make fine sport.

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Answers to Questions on page 57

1. The bee and the silkworm. See page 20
2. If you bow to an albatross in the courtship season, the bird will like as not return it. See page 57
3. The garnet. See page 30
4. The turtle. Attempts to kill snapping turtles in a gas chamber indicate that when the air is not to their liking they can suspend breathing for an extraordinary length of time. See page 48
5. False. Penguins cannot fly; and they cannot distinguish sex even at close range. See pages 56 and 57
6. True. Ants in western United States sometimes bring garnets to the surface. See page 30
7. (a) The albatross. Royal and the wandering albatrosses sometimes reach eleven and a half feet in wingspread. See page 55
8. (b) A tortoise. This creature lived on the island of Mauritius. See page 47
9. Anticosti, in the Gulf of St. Lawrence. See page 25
10. The Indian sign language, which was developed as a sort of universal speech when the bison chase brought fifteen or 20 tribes speaking different tongues into contact with one another. See pages 32 and 33

BIRDMAN OF THE OPEN SEA

Continued from page 57

peror penguin. Often equal in weight to a timber wolf, he is an astonishingly formidable opponent on the slippery ice of his home grounds. One ship's record reveals that eight men attempted to capture "the champ" alive. Lashing out with his flippers, the bird dealt bruising haymakers until all eight of his would-be captors were strewn around the ice. He was momentarily subdued when one of them pinioned the terrifying "fists" with a leather strap. Everyone sat down and drew a deep breath. But so did the penguin. The strap burst instantly, and finally they had to truss him up with rope, after which he was hoisted to the deck. Released, he knocked the inquisitive ship's dog cold, sweeping him into the scuppers with one mighty right hook.

Such engaging and illuminating accounts of oceanic bird life are interspersed throughout the species biographies in Murphy's two splendid volumes. The books combine readability and sound science in so nearly perfect a blend that their scarcity would seem a setback to world education. As has frequently been deplored, a mere 1200 subscription copies were printed, two of which belong to President Roosevelt. This leaves only 1198 for the rest of us and it is high time some sagacious publisher took the existing color plates under his wing and balanced the budget.

But if Doctor Murphy's influence has been artificially limited in this regard, it has found other outlets. A noted lecturer, he has spread the good word for wildlife conservation all over the country. Many popular articles on the same topic have come from his pen and, as Director of the National Audubon Society for 20 years, he has been active in the promotion and enforcement of beneficial legislation. Nor has he lacked for honors. He and Doctor Chapman, are the only living honorary presidents of the National Audubon Society. He has won numerous medals: The Brewster Medal of the American Ornithologists' Union, 1937; John Burroughs Medal, 1938; Cullen Geographical Medal for 1940. Above all, he has worked unsparingly to the end that mankind may learn to understand not only the birds of sea and land but all of Nature. A few words from him of particularly timely importance are herewith subjoined:

Reprinted from the New York Herald Tribune, *July 28, 1940.*

"The people of the United States face today the most pressing responsibilities that any of their living generations has known. . . . We must turn more of our leisure into discipline. Not only our gains but even our needs must flow into armaments. Constructive research that would brighten the future of all mankind must be sidetracked to meet a threat against priceless traditions. The urgent call extends, indeed, out beyond our own gates as far as the most distant victims of unprecedented calamity.

"This is the cause of stern necessity. But, while we throw our strength behind it, let us remember always that the means are not the end. We have no intention of militarizing the guiding thought of our nation to the exclusion of more enduring things. Music will outlive the rattle of machine guns and painting the splotch of camouflage. A healthy countryside, the irreplaceable native flora and wildlife —if we succeed in keeping them—will abide longer than battleships, but, unlike precious paper and canvas, they cannot be saved in the depths of bombproof shelters.

"The conservation of natural resources is never more important than under the shadow of hostilities. We have seen in the last war, when the dust bowl was born, how haste can join with ignorance to wipe out the fortunate climax of a million years of growth. Education must still point forward rather than into the detour. Such wisdom as Americans now possess in the appreciation of undespoiled nature was not learned by men and women; it was, for the most part, implanted in the sensitive minds of the children they once were. This work, too, must go on, not diminished but enhanced. Its cost is relatively trifling but, as an essence of preparedness of the spirit, we cannot afford to see it crowded out. For one day, soon or late, the mists that shorten vision will lift again, and eyes too long diverted must be ready for the renascent brilliance of the view ahead."

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OLUME XLVII, No. 2

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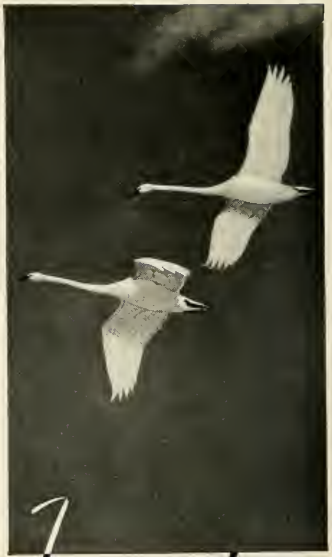

Natural History

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Above illustration painted by F. L. Jaques, from Bird Group of Hudson Bay Region in the American Museum of Natural History

LETTERS

Sirs:

I turned to the December number of Natural History this morning and began reading "Unchallenged Champion," by E. Thomas Gilliard. The story was so fascinating that I read to the end without rising from my chair. It was a marvel of discovery, and at such a price. It is hard to visualize students or easy chair scientists climbing mountains under such hazards as those men endured. . . . One finds only one disappointment in the tale: the failure to find the headwaters of the falls or the gold.

But I had planned to write you before regarding the article on the evolution of the horse in the November issue. There are two questions in the mind of this novice:

1. How can the scientists reconstruct an animal from the small fossilized fragment that he finds? A mere "shinbone or a piece of an ear," seems utterly insufficient material from which to build a horse.

2. How does it occur, admitting the truth of the reconstruction, that the horse has evolved larger than his ancestors? In the case of the elephant, it has been a decrease from the mammoth to Jumbo. Also the dinosaurs have been replaced by much smaller reptiles. Why then has the tiny five-toed "Dawn-horse," Eohippus, developed into the 2200-pound Belgian champion draft horse?

These questions are amateurish, but I am only an inquirer.

Augusta, Ga. (Rev.) I. T. Hawk.

The following information in answer is given by Dr. George Gaylord Simpson, the author of the article on Eohippus referred to:

1. Scientists cannot and do not reconstruct whole animals from a fossil fragment, a mere "shinbone or a piece of an ear." They sometimes can *identify* an animal from a fragment, but not *reconstruct* it. For instance you might find a human tooth and by careful study you could be sure it was human, which is identification, but you could not tell whether the owner was male or female, handsome or ugly, black, white, red, or yellow, or, in short, you could not draw a picture of the person, which would be reconstruction or restoration. As I tried to emphasize strongly,—indeed it was the point of my article—, reconstruction of Eohippus was impossible until virtually the *whole* skeleton was known.

2. It is the rule in nature that animals tend to become larger with the passage of time, not smaller, and the horses followed this rule. There are exceptions, and it is not known certainly why evolution usually makes animals larger, but it is certain that this is a fact. The elephant is not a mammoth reduced in size. In the first place, some elephants are larger than some mammoths. In the second place, the common and largest mammoths were not the ancestors, but, so to speak, the uncles of the elephants. The direct ancestors of the elephants were smaller than the living descendants. The same is true of the dinosaurs and later reptiles. The big dinosaurs were themselves derived from smaller ancestors. They became extinct without leaving descendants. The smaller reptiles that followed them were larger than their own ancestors, not dinosaurs, that lived in the age of dinosaurs.

* * *

Sirs:

We enjoyed the story "Where the Cats Came From" . . . A. C. Burrill,
Curator.

Missouri Resources Museum,
Jefferson City, Mo.

* * *

Sirs:

While in the library I was attracted to your magazine Natural History by its beautiful cover design. I liked especially the articles, "Miracle on Wings" and "A Snake in the Hand" . . .

New York, N. Y. Ira Samuelian.

* * *

Sirs:

I read with interest and a good deal of agnosticism "A Snake in the Hand," by E. Ross Allen, as told to Merle Park Merryday. I have been collecting venom from the water moccasin for a number of years and have been working on the bibliography and actions of the venom. There are a number of rather serious errors in the article:

In the account of Doctor MacDonald there is the parenthetical remark that the antivenin contained enough rattlesnake venom and horse serum to kill a crocodile (page 235). The antigen contains the venom; the antivenin contains none.

Experiments on snake venoms did not begin "early in the present century." The great works of S. Weir Mitchell and his co-workers were published between 1860 and 1897. A survey of the bibliography of Mitchell and Reichert's *Researches Upon the Venoms of Poisonous Serpents* will reveal much earlier work.

On page 238 of the article, this statement is made: "When dried it [i.e., the venom] loses 20% of its weight and appears as white or yellow crystals, which are soluble in water. Cold has no effect on these crystals . . ." This contains two errors: (1) the percentage of water; (2) the nature of the dried venom.

The venom is a mixture of numerous substances: proteins, inorganic salts, water, cells, and cellular debris. It dries in scales or irregular particles, which have a fairly high refractive index (1.558 by my measurements) but are amorphous, not crystal-

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line. This was observed by Mitchell and Reichert. Their description follows: "... it dries into a beautifully cracked mass, deceptively like an aggregation of crystals."

The statement as to the water content of water moccasin venom is apparently a perpetuation of an old error in the literature. Mitchell and Reichert give the water content as 27.42%. H. Noguchi, in his *Snake Venoms, An Investigation of Venomous Snakes with Special Reference to the Phenomena of Their Venoms,* cites S. Flexner and H. Noguchi as finding the water content 30-50%. However, Wolff and Githens give the water content as 72%; own figure is 75.70%, when the fresh venom is dried immediately *in vacuo* over calcium chloride. All these figures are for water moccasin venom; other venoms are quite similar, however.

Mr. Allen states that venom is odorless. H. Noguchi states, "The peculiar odor, often attached to venom, has its origin in the snake itself." This statement is obviously ambiguous. I have always been able to detect a slightly nauseous odor in the venom I have collected. This odor is as described above. The odor is similar to that of egg white.

In view of the numerous errors, I can hardly accept the rest of the article as more than another interesting "snake story."

Robert V. Brown.

Michigan State College
East Lansing, Mich.

Ross Allen answers Doctor Brown's criticisms and "agnosticism" as follows:

(1) Regarding the parenthetical remark in Doctor MacDonald's account of his snake bite, we did not attempt to change the original report of the case. It is true that antivenin is a product made from horse blood after the horse has been made immune to snake venom.

(2) In our article we did not give any date as to when experiments on snake venom began, but referred to work on treatment of diseases, which did begin early in the present century. Study of snake venoms, as such, is a different subject; therefore, I believe Doctor Brown's criticism is not justified in this case.

(3) This is a typographical mistake and should have read, "and loses all but 20% of its weight." Almost every day I answer this question in public on how much water is in snake venom, and our answer is 80%.

Regarding the second part of the third question, I cannot see where we erred in our statement. We have found that the public understands better when you describe venom as "yellow crystals," even though it be granted that dried venom is not crystalline. We have also found that there is a great variation in the amount of water in venoms, and Doctor Brown is incorrect in thinking that all venoms are similar.

(4) We are correct in saying that snake venom is odorless, because in the article we referred to snake venom freshly taken from the snake. I have never been able to find an odor in fresh venom, that is, immediately after the snake has been milked. However, there is a nauseous odor in venom after it has been in contact with air. Venom improperly dried has this odor.

... Since it was an article for the public, we tried to put it in the layman's language and did not take up space with uninteresting references and statistics but gave our own experiences as we had them firsthand. . . .

* * *

Sirs:

Your recent article on a sting by a venomous snake has caught my attention . . . Are venomous snakes known to exist in the State of Maine? I have grown up in the popular belief there were none, as have all my neighbors. But your recent magazine issue called to mind something that happened to me about four or five years ago. I saw a snake lying one morning coiled in the shaded roadway under our elms, and went to scare him out. He didn't move, which surprised me. He was about twelve or fourteen inches long, of a general brownish color, I think. I took him for one of the adders that are very common here. Just as I stepped in front of him, I heard a faint sound, something like a vibrating "whir." I didn't connect it with the snake till my attention was called to his tail, which looked like two tails. It stopped just as I looked at it, and I could see it was only one, but it must have been vibrating hard and fast, for a spiral of dust was coiling up from the road where it lay. It was unlike any snake tail I had ever seen, the only one that didn't taper down to a fine point at the end. It was about the size of my little finger, looked as though it had been tightly and evenly baled round with wire, with one strand baled over the end lengthwise, so that two bulges like knobs were produced, and there seemed to be traces of more of them coming on either side. I looked at that tail, I think, about two seconds before the snake struck like a flash at my ankle. I jumped back out of the way, after which he fled off into the bushes by the stone wall.

Though I had never heard a snake make a noise before (I'm told they hiss but I have yet to hear it), I thought he must have wagged his tail hard enough to make it whir, and though that was new to me too, in time I forgot all about it. Last summer (1939) I looked at your June issue and saw the illustration of a diamondback rattler. The first thing my eye fell on was the peculiar knobbed tail, and I think my temperature went up ten degrees. My snake did not rattle, at least not what I call a rattle . . . Can you tell me if there is any possibility that this snake was a rattler? If not, then would any of your staff know of a snake that fits what little description I am able to give? . . .

Can you tell me if rattlers are supposed to exist in Maine? I had always thought we hadn't a venomous snake for a radius of hundreds of miles. Are rattlesnakes found in New Hampshire? I've been told they are, but can't vouch for the truth of it . . .

Gertrude A. Hardy.

Westbrook, Me.

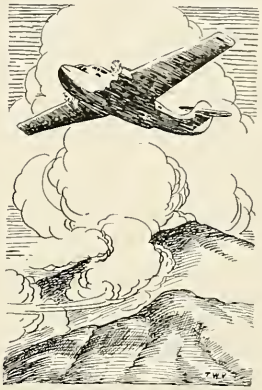
Charles M. Bogert, of the American Museum's Department of Herpetology, answers Miss Hardy's questions as follows:

Many of the harmless snakes in this country, as well as in other continents, vibrate their tails in much the same fashion as do the rattlesnakes. Indeed, we have reason to assume that the vibration of the tail probably preceded the evolution of the rattle, and further, was a factor in its development as an organ used expressly for purposes of intimidating and alarming the enemy. Our larger snakes, in particular the racers, black snakes, and pine snakes, vibrate the tail in such a manner that if they happen to be in contact with dry leaves or even twigs in the underbrush, a noise comparable to that made by rattlesnakes is produced. This may, of course, be construed also as "mimicry" of the rattlesnakes, and may be of real value to the harmless snakes, since we definitely know that certain enemies of snakes will not attack a snake with rattles.

The knobbed tail on the snake observed by Miss Hardy may have been normal, but many snakes lose portions of the tail through accidents of various sorts, and a "blunt tail" is not a rarity on most of the larger species. The State of Maine can probably claim the distinction of being the only state in the United States that has no indigenous venomous snakes. Two records of the timber rattlesnake in Maine were published in 1863, but these have never been substantiated, and the copperhead is known only as far north as eastern Massachusetts. Rattlesnakes are known in New Hampshire, specifically in Carroll and Merrimac Counties. Therefore, we feel quite safe in stating that the snake encountered is quite harmless, despite the fact that it struck in such a business-like manner. Many harmless snakes, particularly young ones, frequently resort to the most impressive displays, but it is entirely bluff, calculated to intimidate the enemy. Usually the widespread mouth is closed before it actually reaches the enemy since without fangs, such a "strike" would be ineffectual at best.

Continued on page 115

THE MUSEUM AND EXPLORATION



OUR EARLIEST ANCESTORS had an impelling desire to find out what lay over the next hill; what secrets were hidden in the primeval forests; what those lands glimpsed through the gray mists across the Arctic Sea, were like. This restless desire to know the world about him sent primitive man wandering to the uttermost corners of the earth.

After the dawn of civilization the same urge to know all the lands and seas sent the Vikings and Columbus to discover the New World. It sent Magellan and De Soto, Lewis and Clark, Stanley, Peary and Byrd and countless others to mark on the map every mountain range, lake and desert and river.

But modern exploration is not the same job that it used to be even twenty years ago. The old days of the Arctic explorer foot-slogging behind his sledge are gone. Exploration has entered a new phase.

The great pioneer lines of discovery have been thrown across the continents in every direction. Today there remain but a few small areas of the world's map unmarked by explorers' trails or where an airplane has not droned about the mountain peaks; only a few small areas whose topographic features are unknown. But that does not mean that there are no new worlds to conquer! It means only that the explorer must change his methods. There are vast regions which potentially are *terra incognita*. Many are mapped poorly, if at all, and some hold undreamed of treasures in the realms of science. To study these areas, to reveal the history of their making, to learn what they can give for education, culture and human welfare—that is the exploration of the present and of the future.

But in order to learn the history of a country one must make collections—rocks and fossils, mammals, birds, insects, reptiles, plants, fish, archaeological remains and specimens of anthropology. All these must come to an institution for study if we are to interpret them correctly and see how they fit into the great scheme of nature. Also they must be permanently preserved. Universities are not equipped to handle large collections; neither are geographical societies. Museums stand alone in their facilities for scientific exploration.

From the very first it was recognized that exploration is the lifeblood of a natural history museum. It brings to the institution new facts for research and publication, new specimens for exhibition and for public education. Some of the greatest expeditions of modern times have been fostered by the American Museum. In 1930 its exploration program reached the maximum with 37 expeditions in the field. Today we have less than ten, but the need to push scientific exploration vigorously is increasing every year.

Since transportation by air and motor has made accessible even the most remote parts of the world, primitive conditions are rapidly changing. Native tribes are disappearing and animals, birds, and faunas are being exterminated with no records of their existence left for future generations. In view of this, it is the duty of the American Museum to carry on explorations and obtain these records for its studies and collections before they have vanished from the face of the earth.

Roy Chapman Andrews

The American Museum of Natural History

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The Magazine of the American Museum of Natural History

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(From a Kodachrome by Charles H. Coles)

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AMNH photo by Coles

THE MANDRILL as it will appear in the new group now being constructed for the American Museum's Akeley African Hall

SAA COMES OF AGE—Lif

SAA* clung desperately with grasping hands and feet to his mother's shaggy sides as, together with a score of other frightened monkeys, she raced silently aloft by branch and bushrope to hide herself and her child in the very attic of the tropical forest. The leader of the troop, a huge blue-faced old mandrill, had exploded one startled "oomph-a" of warning and the next instant had crashed into full flight through the dense underbrush. A few seconds later he could no longer be heard.

The rest of the band, females with babies, young adults, boy and girl mandrills—all obeyed their common instinct: at the sound of the "Old Man's" savage grunt each sprang for the nearest tree or vine and swarmed into the treetops.

At that moment wild yells burst from the lungs of negro hunters who had stealthily encircled the unsuspecting animals. "Clonk. Clonk," sounded the wooden rattles tied under the necks of two hunting dogs just slipped from their leashes. The dogs quartered the ground beneath the treed mandrills, trying in vain to pick up the scent of the wary old male, already far away.

Two of the hunters fired their guns at climbing animals which had lagged slightly. Others aimed powerful crossbows that discharged deadly little darts tipped with *ne,* the arrow poison of West Africa.

The N'dungu word for mandrill monkey.

A mandrill swayed, climbed more slowly and hid in a huge fork. Another crashed instantly to the ground. As the shooting continued, the monkeys began running through the high branches, springing from one to another with wonderful agility and dextrously keeping thick limbs and foliage between their bodies and the foe below. Yet before they could get away more were shot down.

Saa's mother, as lithe and cunning as any in the band, had been hunted before. One of the first monkeys to reach the treetops, she had hidden in a mass of leaves and vines growing near the summit of one of the biggest trees. And there, despite the clamor and the shooting, she had stayed trembling with her baby.

A dull thud a short distance away marked the fall of a mandrill shot with a poisoned dart. It had died about two minutes after being hit. The dart had been cunningly prepared, partly cut through just behind its poisoned tip, so that if a wounded monkey tried to pull it out it broke off, leaving the venomous point inside the puncture.

Farewell to the fallen

Saa still clung tightly to his mother's hair. Motionless the two watched the bush-men below. They saw their dead comrades, strangely limp, collected and flung in a heap on the leafy ground. They watched hands and feet being tied together, and poles passed between the lashed limbs, so that the dead animals hung from the poles.

The black men, laughing and chattering, ate some food which they had carried rolled in leaf wrappers. Then they shouldered the pole-loads of dangling monkeys and carried them away.

For a long while Saa's mother remained silent and motionless in her hiding place—for so long that Saa, forgetting his recent experience, fell asleep. At last she stirred cautiously but almost instantly "froze," as her keen eyes caught a movement in a tree not far away. It proved, however, to be a young mandrill who had also hidden himself safely. Presently several others of the group showed themselves. The leg of one was bleeding from a small bullet wound.

In anxious refuge

Uncertain and leaderless, the survivors of the massacre wandered in the forest. One or two young mandrills scouted for fruits, nuts and insects. With the approach of darkness the youngsters climbed with their elders into the branches. Each monkey chose a crotch well above the ground where, fair or rainy, he passed the night hours. But the animals remained uneasy. They missed the vigilant old leader who customarily placed himself on guard beneath them at the base of a tree, or sometimes climbed a few yards above ground.

Dawn spread over the land. Light picked out the tops of the trees while night yet reigned below. Presently mandrill after mandrill slipped down among the drenched undergrowth and began to search for breakfast. In October two favored foods were common: large, round nuts locally named "iron-nuts," pulpy and pleasantly scented inside, and giant beans whose twin cotyledons split apart soon after the beans fell from their foot-long pods. The mandrills were accustomed to feed freely on that fare. Often they carried additional supplies in their capacious cheek pouches. To amplify their fare they scratched up the ground or tore apart rotting logs in search of fat, white beetle grubs.

Though forgetful of their fright the band remained uneasy. They tended to keep moving. From time to time one or another individual tried unsuccessfully to assume leadership in the absence of the old chief. Though the troop as a whole lacked cohesion, most seemed to have forgotten the cause of it all. Conversations started: confidential "qua-qua-qua," and angry "ca-ca-ca-ca-ca," as one chased another who had snatched a morsel of food. But mainly the silence was broken only by the faint sound of pulpy nuts being munched or the fall of a rotten stick dislodged by a shaken vine.

Saa's mother breakfasted with the other mandrills. She cared for Saa, who as yet had scarcely set foot on earth. The sunlight began to filter through the trees. Shining patches of leaves near the ground attracted brilliant butterflies, which flitted and wheeled about them. In the north, clouds already gathered in readiness to pour the noon-hour showers over the forest.

Suddenly, very faintly came a sound! The mandrill troop became motionless, tense. "Oomp-oomp-oomp," the old chief was calling to his lost flock. One after another the old ones, especially the females, began to move. The younger animals followed. The band's trend of travel showed direction once more.

They did not meet the leader at once. Sometimes he failed to call for an hour, and the band, forgetting its objective, stopped to feed. Bursts of heavy rain dashed over the forest, during which most of the monkeys huddled into semi-shelters. They paid no attention to light showers.

tory of a Mandrill

By G. H. H. TATE

Assistant Curator of South American Mammals,
The American Museum of Natural History

Deep within the forests of West Africa lives the most singular-looking member of the whole monkey clan—the gaily-colored mandrill, whose habits the author observed intimately while on an American Museum expedition. The accompanying story relates one of the most crucial episodes in the social life of these fascinating creatures

They found the chief the following day. No happy greetings were exchanged. All was matter-of-fact. One minute they were alone, the next he materialized, as massive and reassuring as a great Dane.

* * * *

Saa grew into a small-boy mandrill. The flutings on each side of his face became clearer. A tinge of yellow-brown around his neck suggested where the handsome ruff of adulthood would appear. As yet no trace of the blue and red, such as marked the visage of the old chief, appeared on Saa. He was still a small gray-brown monkey with a very short tail and hard, horny calluses where he sat down. But now he could forage for himself. He could run among the branches with the grace of a cat. And he played endlessly with the other mandrill children.

Months passed. After the shooting episode, the "Old Man" had led his charges deep into the forest to the north. No other hunters had been seen. The band had moved far out of earshot of the rumbling trucks that daily traversed the dirt road between Kribi and Lolodorf.

A new home

One day they came to a patch of forest where small trees and branches had been torn and smashed. The ground appeared trampled by huge, flat feet. The old mandrill quietly withdrew. "Mandrills fear elephants," say the bush-men.

There Saa grew up. His once short face lengthened and took on the dog-like form of the adult male. Four huge canine teeth replaced the little ones of childhood. Great bony ridges swelled each side of his muzzle. The fluted areas of skin, covering the ridges, became clear, pale blue. His nose grew yellowish, shot through with streaks of crimson; and along its top, from between his eyes to its tip, a red-purple line developed.

His hindquarters turned as blue as his face, and patches of red appeared; there the hair thinned, letting the colors show through. Around his neck a mass of tawny yellow hairs formed a fine ruff, which joined a crest of hairs on the crown of his head, a crest that stood erect when he grew angry.

He became angry rather easily now, especially with the other young males of his own age. But the old leader kept him and the others in their places, sometimes even driving the more aggressive animals away from the tribe. Such secessions were costly because the retiring male often enticed several females to accompany him.

Next to the leader, Saa became the largest, strongest mandrill in the group. Some months later the inevitable fight for dominance occurred. Saa felt fit and sure of himself. Perhaps it was due to the obvious admiration lavished upon him by several young lady mandrills, his erstwhile playfellows; but mainly it was because he had come of age, reached his full strength and stature, and sensed that every nerve and muscle was in fighting trim. The young ladies cavorted around near him, obviously flirtatious. Saa, forgetting the chief, pranced proudly and self-consciously before them.

Saa meets his rival

A sound between a snarl and a roar brought him back to reality, as the jealous "Old Man" rushed at him, fangs bared. For an instant the habit of years controlled Saa. He half turned to scuttle away in the bush or scramble for safety up a tree. The next moment something, perhaps the splash of adrenalin in his bloodstream, induced by the cloudy ideas of matrimony drifting through his simian brain only seconds earlier, overcame his instinct to retreat. At any rate he stood his ground, tense, every hair of his great mane erect, and snarled back into the face of the leader.

The two great animals locked in a roaring, screaming heap. The great canine teeth slashed and stabbed, as each strove for a telling hold. The rest of the band took instantly to the trees, whence they commented excitedly upon the fight.

Finally the "Old Man" broke away from his opponent, and bleeding from a score of cuts ran into the forest. Saa made no effort to pursue him. He strutted about the spot where the fight had taken place. Then he began looking for food. The mandrills watching from the treetops joined him.

In his new capacity he nightly crouched near the ground, guarding the troop against the dangers of darkness, while they slept among the branches above him. In the daytime he played wary sentry while his people hunted for food.

Once nearly a year later they met the old leader. His blues had become bluer. The red of his muzzle blazed crimson. His disposition seemed more surly and irritable than ever. Nevertheless, he made advance, which Saa firmly repelled.

Saa's troop of mandrills grew in number to nearly 40 strong and ranged through an area of forest some 20 miles square. Saa ruled the band firmly, as his predecessor had before him. Thus once more the pulse of new blood was beating in the life-pattern of the mandrills.

GEM FOR FEBRUARY

Legend imparts to the wearer of the sparkling amethyst a power so subtle that even a Bacchus may be a sage

By FREDERICK H. POUGH
Assistant Curator, Geology and Mineralogy
The American Museum of Natural History

IN a latitude where February brings snow and cold the amethyst is particularly appropriate as a birthstone. If it had not lost its power, what a boon the wearing of this stone might be today to the insurance of a stimulated warmth and comfort through this cheerless month. For many are the legends which attribute to this rich purple gem great efficacy in warding off intoxication, no matter what the consumption!

There can be but little question that the Bacchic attribution of this gem is based upon the similarity of its color to that of wine. Amethyst is only one of many quartz gems, but it is surely the most beautiful of all. Quartz is a very common mineral, composed of silicon and oxygen and nothing more. But pure quartz is rare in nature, and when it is so found it is often used as a gem under the name rock crystal. More often a minor impurity colors the quartz, usually making it less pleasing. Not so, however, when the impurity gives an attractive coloration, as it does to the amethyst. But even today we do not know the exact cause of the color of amethyst: some think it due to a trace of manganese, though none has been found in the most sensitive tests; while others suggest that it is iron, or even some complex optical result of multiple twinnings within the crystal.

Like all the birthstones, amethyst is one of the best known jewels, but this does not detract in any way from its charm of color and beauty as a gem. In modern times Russia has produced some of the finest stones, and though none come from there today, the Muscovite influence is still felt, for any finely colored stone, no matter what its source, is called a Uralian amethyst, after the Ural Mountains. It is said that this region of almost unparalleled mineral wealth was the standard answer of the Russian schoolboy to almost any geographical question. Upon being asked where anything was found, he had only to answer, "In the Ural Mountains," to be assured of a fair chance of being right. The deep wine-red of the finest quality amethyst is still known, but the Urals no longer supply the world. Brazil and Uruguay have supplanted Russia in that field.

The Brazilian deposits consist of two types: the less important is in a white sandstone that yields large but pale crystals encrusting the walls of caves and fissures; more important are the hollow boulders, weathered from basaltic rock and lined with layer after layer of banded agate, or with amethyst crystal crusts. The latter type is found near the Uruguayan border. Tremendous slabs of these crystals have been collected, varying in color from very pale purple to deep shades as fine as those from Russia. Carbon dioxide gas is often included in these crystals, and many specimens in collections show small pits where the reduced pressure of the surface has permitted the confined gas to escape by exploding outwards.

Coloration in an amethyst is almost always irregular. Most genuine amethysts, when viewed through the back, can be identified by an irregular distribution of areas of colorless or pale purple quartz and areas of deeply colored amethyst. Imitation amethysts are uniformly colored. Although amethyst has been found in the United States and many stones have been cut, some of high quality, the American supplies are neither large nor consistent enough to provide much of the world demand and are consequently of little economic importance. Maine, New Hampshire, Virginia, Georgia, Montana, and many other states have all produced some gems, and there is hardly a state in the Union where collectors have not found purplish quartz which could be considered amethyst.

AMNH photos by Bierwert

An amethyst crystal from Georgia

A carved amethyst snuff bottle from China

An old French verse tells of the origin of amethyst: Bacchus was vexed with Diana and vowed to set his beasts upon the first person he met in the forest. This chanced to be Amethyst, a beautiful maiden. When she appealed to Diana for aid, she was turned into marble and spared from what is supposed to be a worse fate. Bacchus in contrition overturned his wine glass on the petrified maiden, dyeing the marble the color of the juice.

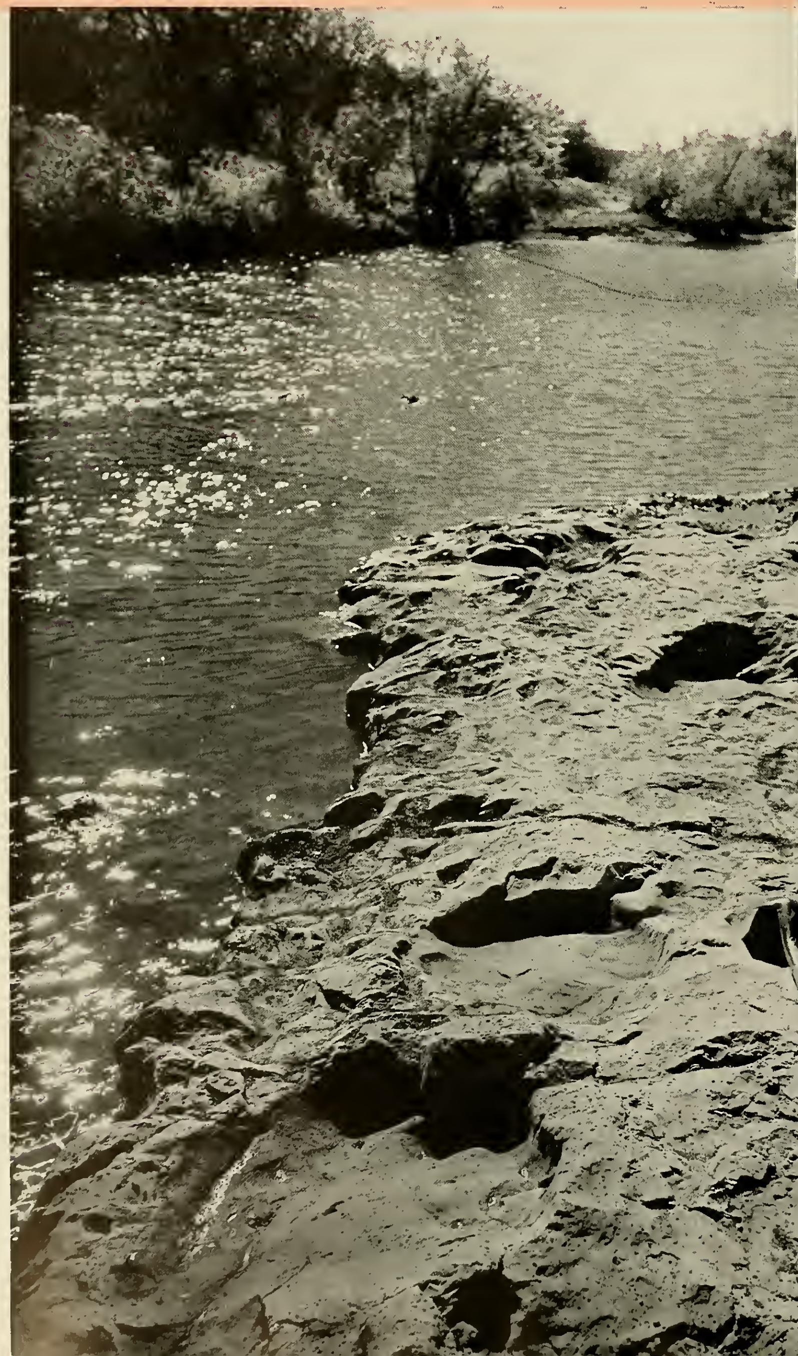
The oldest attributes of amethyst all deal with its efficacy in warding off intoxication. In common with other gems it was supposed to guard against illness and control evil thoughts. Others thought it would quicken the intelligence and make men shrewd in business, keep soldiers from harm and help them to conquer their enemies.

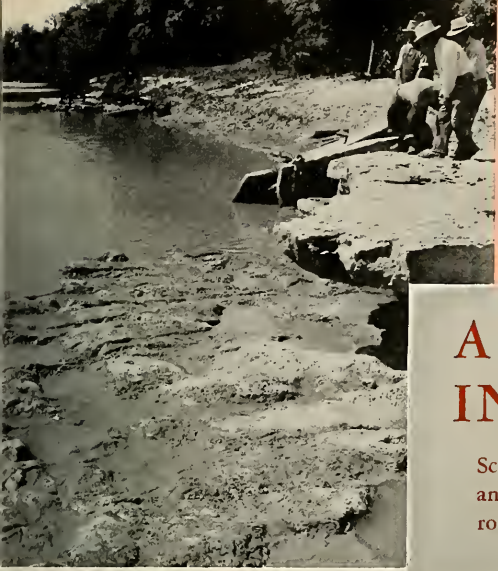
Even in the Christian religion the amethyst was regarded with respect. St. Valentine, whose day falls within this month, is supposed to have worn an amethyst ring with a figure of Cupid engraved upon it.* The name amethyst is derived from a Greek word meaning "not drunken." Another name, Bishop's Stone, comes from its customary use in the episcopal ring. Evidently the amethyst's special efficacy was not overlooked by bishops, who must remain sober, but whose duties, as L. J. Spencer puts it, take them to all sorts of public functions. G. F. Kunz suggests the interesting thought that the Hindus included almandine garnets under the name amethyst, and may have carved from them cups in which the wine color would not show, so that one could drink pure water from them and give the impression of extensive drinking yet remain sober.

Amethysts were much more highly valued formerly than they are today. A necklace once valued at $10,000 is said to be worth hardly $500 today. Even though the supply is now more abundant than formerly, the demand is excellent. Despite the modern disillusionment of the amethyst's power over alcohol, its lovely color has insured a constant demand. The continued production of high quality material has kept the price of amethysts within the means of all who like to wear jewels, whether they were born in February or not.

**It is doubtful whether either of the saints known as Valentine was a patron of romance. See "The Massacre of St. Valentine's Day" on page 100 of this issue.*

(Below) ORIGINAL DISCOVERY: the footprints of one of the most gigantic animals ever to walk on earth, a sauropod dinosaur. Only right hind and forefoot impressions were at first visible, but the trail continues underwater toward the rocky point beyond. Examination of the many additional prints was to settle the argument of whether these dinosaurs walked on all fours or crawled. Hind footprints were 38 inches long and 26 inches wide, and showed four claw impressions. Forefeet were smaller, more rounded, and the toes terminated in fleshy pads lacking the single claw known to have been carried by other sauropods whose skeletons have been found





(Left) FIRST MOVE in following the trail was to construct a cofferdam of sandbags so that the area could be drained and the tracks examined. Originally made on a soft mud flat, the trail was later covered by silt laid down in comparatively quiet water. On top of this, inland seas which invaded parts of Texas approximately 100 million years ago deposited sediments. These ancient, consolidated deposits have long since been elevated high above sea level, and the tracks have been exposed by the cutting action of the Paluxy River, which flows across them today

A DINOSAUR WALKS INTO THE MUSEUM

Scientific detective work sheds new light on the habits and appearance of the most gigantic animals that ever roamed the earth when the biggest footprints ever found are placed on display

By ROLAND T. BIRD

Department of Paleontology, The American Museum of Natural History

WITH PHOTOGRAPHS BY THE AUTHOR

PIECING together the story of prehistoric animal life is, in its entirety, a gigantic scientific detective problem. Rarely, however, does the process suggest so closely the classic methods of Sherlock Holmes as in the case of the footprints of the "Thunder Lizard," for important new information on the appearance and mode of life of this titanic dinosaur has been deduced from the trail which he left in mud some 120 million years ago.

The general appearance of the "Thunder Lizard" has been known from abundant skeletal remains, fossilized in the rock pages of the earth's history. But whether he walked on his four feet and trod the dry earth or lumbered about in shallow water, remained unknown, along with other important facts, until the eye of science fell upon these tracks.

Of all creatures that ever walked on earth, the "Thunder Lizard," Brontosaurus, and other dinosaurs of his group, the sauropods, hold the world's record for size. Indeed, they seem to have reached the possible limit that an animal with feet could attain. A few other sauropods were larger, but Brontosaurus is typical of the group.

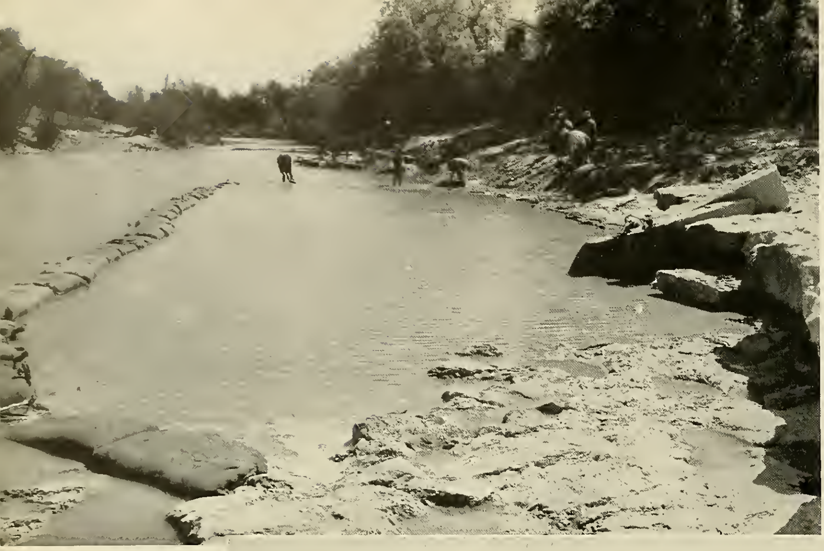
One day late in November, 1938, while prospecting 80 miles southwest of Ft. Worth, Texas, I noted three or four huge depressions in the bed of the Paluxy River,—footprints of these gigantic monsters. On a rock ledge leading underwater was undoubtedly a trail left by a 60- or 70-foot sauropod weighing 20 or 30 tons, probably the "Thunder Lizard" himself. Specimens of this sort were hitherto unrecorded, and I faced the problem of removing a suitable selection for the American Museum.

The task promised to be in keeping with the magnitude of the tracks involved. How would one cope with the whims of a temperamental river while tracing 38-inch footprints underwater? By what method could a suitable section be removed from the solid rock? At each stride the animal moved ten or twelve feet. Where, indeed, could such a large exhibit find room in the Museum's halls?

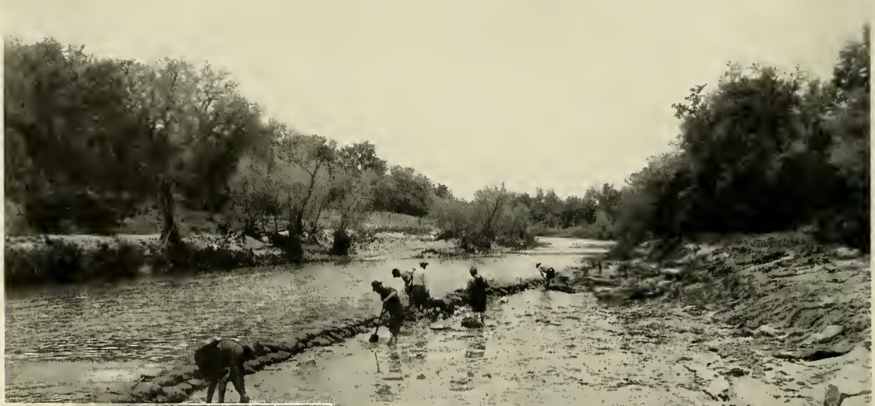
Almost two years later to a day, after five months of intensive work, the largest single display of dinosaur tracks ever uncovered was boxed up. With so great a wealth of material available, two other institutions shared in the collection. In all, 40 tons of track-bearing rock were removed from the river bed.

Visitors to the new Jurassic Hall in the American Museum will in time see the original footprints mounted in the base of the gigantic skeleton of the "Thunder Lizard." As if this 120-million-year-old monster had just strolled into his present position in the hall, you will see the tracks as he would have left them, six front and six hind footprints, under glass resembling the water in which he waded. This solution of the exhibition problem had already occurred to curator-chief Barnum Brown's fertile imagination before the venture was assured.

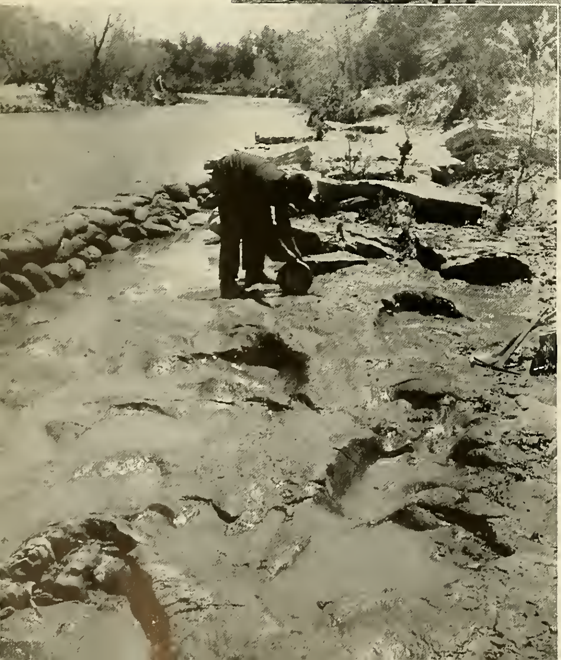
What the tracks revealed and how they were removed with the aid of the Texas State-Wide Paleontological Survey, a Works Progress Administration Project, is told in these pages. To Dr. E. H. Sellards of the Bureau of Economic Geology of Texas goes credit for having made possible this valued assistance. To all my other Texas friends, far too numerous to mention singly, who helped in this quest, both at Glen Rose and Bandera, where one other known locality for this type of track was found by us, I extend my heartfelt thanks.



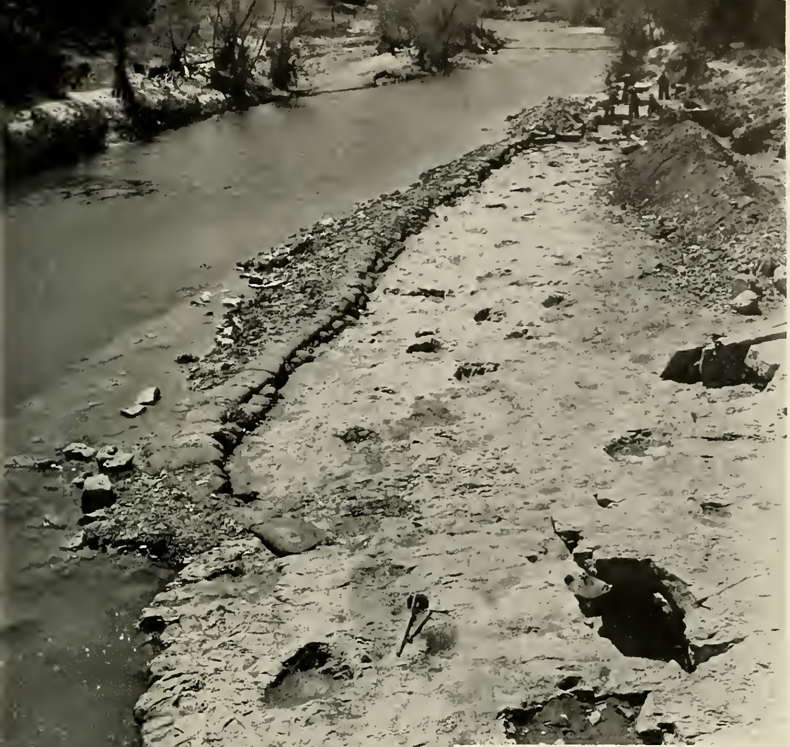
(Left) THE DAM rapidly nears completion as men drag sandbags across the mud-filled potholes that mark the course once followed by the dinosaurs. Fossil-hunting, entirely a new experience to the crew, all local men, excited mild curiosity in some, in others, keen interest. When told that the name Brontosaurus means "thunder lizard," Monroe Eaton declared, "One certainly went here that shook the ground"



(Above) TRACKS begin to appear as water is drained from the area. Lacking a gasoline pump, the men used buckets to remove the water, and could bail about twelve barrels a minute by this method. Keen to see what the tracks were like, they completed the task in less than two hours. But recurrent floods were to refill the dam many times



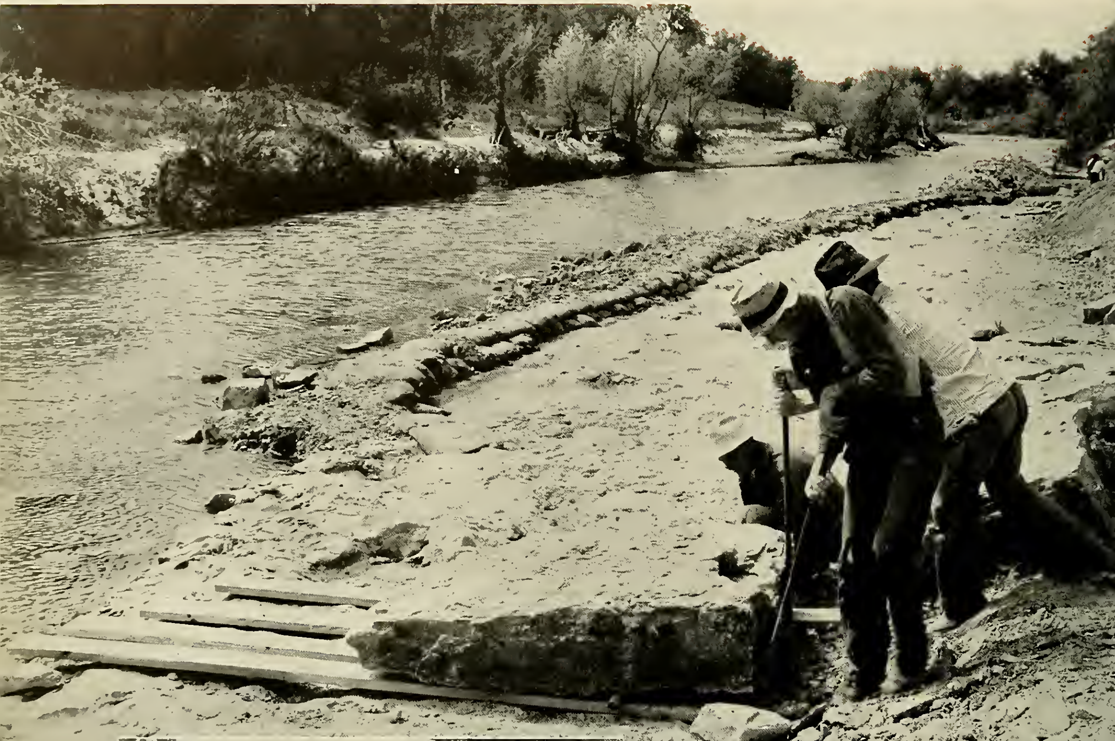
(Left) THE BIG TRAIL led toward a shelving ledge and disappeared beneath it. One local man, inclined to scoff at the notion of finding additional tracks beneath the undisturbed overburden beyond, laughingly said, "Why, that animal didn't walk under all that rock!" Actually, of course, the dinosaur walked before the overlying rock was deposited as soft sediment. From a study of the rocks the scientist can reconstruct the landscape and climate at the time

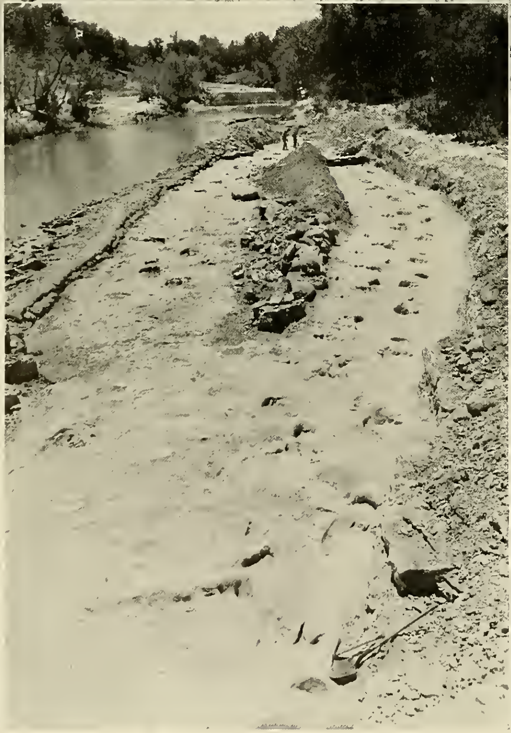


(Left) A VIEW looking upstream along the tracks which had been underwater discloses positive proof that this great animal walked on all fours, for the hind and front footprints are clearly discernible in regular order. Only in one trail, at Bandera, were there eight or nine forefoot impressions and only one hind one, where a sauropod, buoyed up enough to go on fore legs, had put down a hind foot to turn. The absence of any mark of a dragging tail except in one instance was the next clue to the dinosaur's habits. Fully 25 feet long and very heavy, the tail could not have been carried in the air. Therefore, the animal must have waded in the water, where the tail, tending to float, could have been held off the bottom

(Below) AN EXCAVATION revealed much more of the path of the dinosaur, which swung gradually to the right. Was the dinosaur alone when he waded across the mud flat 120 million years ago?

(Left) ANOTHER TRAIL is found. While widening the excavation, a new series of even more promising tracks was located, coming in from the north on the bank side. Again beckoned by the unknown, the diggers began a new excavation to trace this second trail. Further surprises were in store

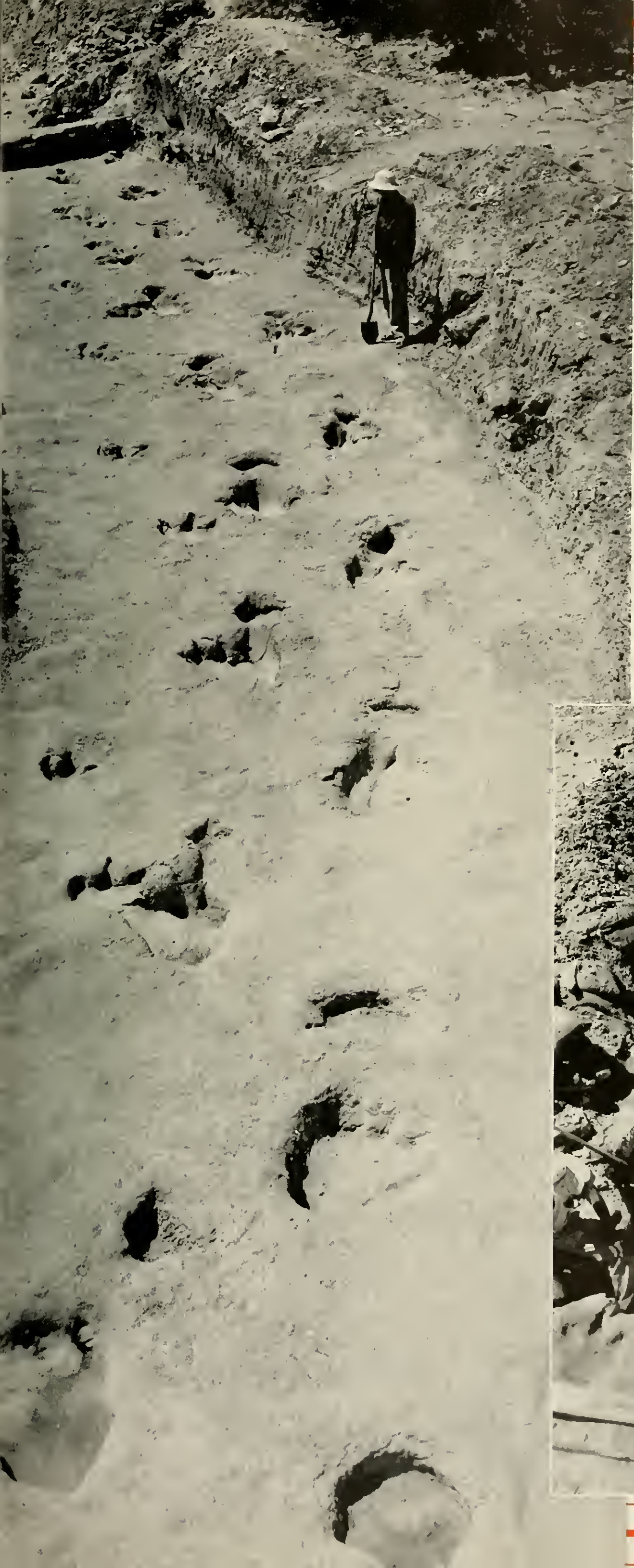




(Above) A JUTTING LIMESTONE LEDGE is in the way, so it must go: broken sections being moved away with the aid of bars and rollers. It contained many fossil oyster shells and other marine invertebrates left there when the sea advanced over the area.

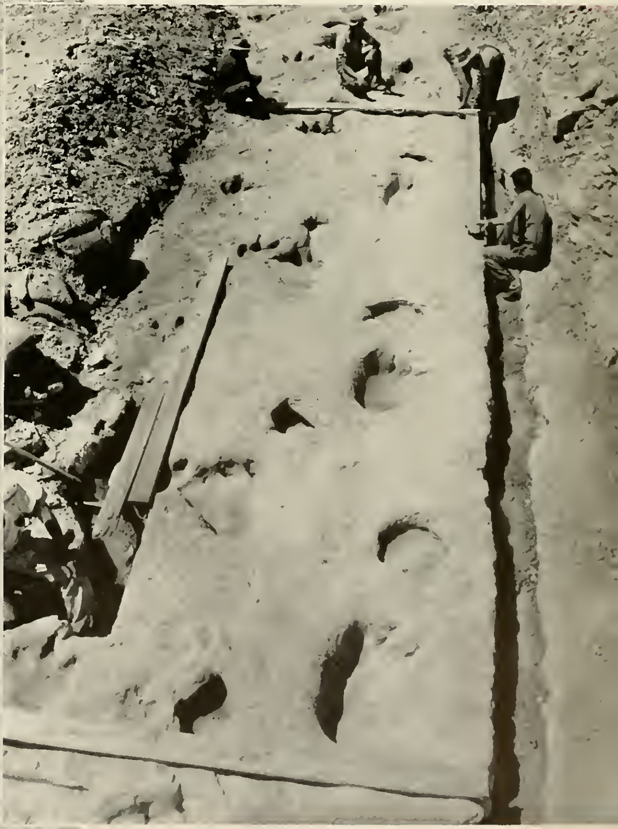
Why have no sauropod tracks been discovered farther north in the United States, where skeletons of the animals have been found in large numbers? Dr. Brown deduces that only in seaside mud flats, as distinct from lake marshes, would the putty-like earth of decomposed marine organisms be firm enough to receive and hold the impression of the feet while underwater. Preliminary examination of the rock bears out the conclusion that the dinosaurs here were wading in a shallow, brackish arm of the sea, though the spot is now almost 300 miles from the coast. Farther north, where sauropods frequented the lakes, they died in great numbers in diminishing pools when the drying up robbed them of the water necessary to their existence

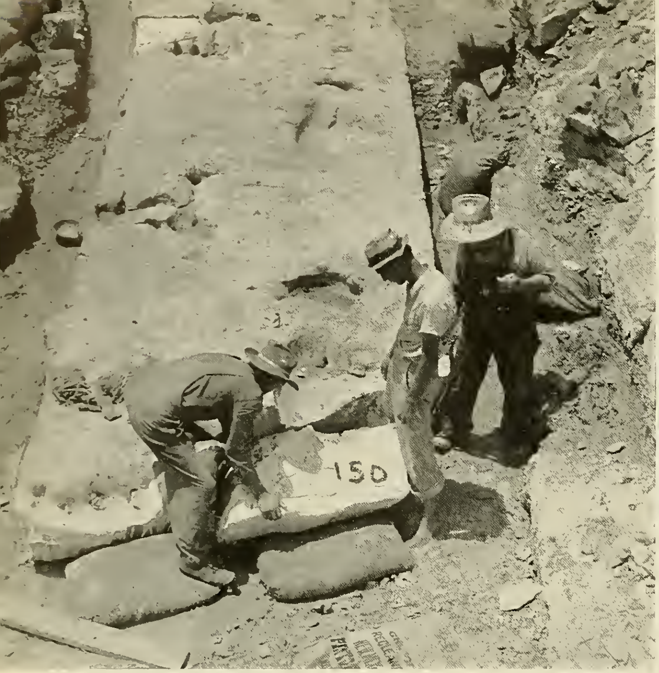
(Left) WITH the limestone ledge blasted and cleared away, Trail Two stands out clearly on the right. Other trail disclosures indicate that no less than a dozen sauropods had crossed this section. All were progressing in the same direction as a herd moving across a shallow mud flat



MOST INTERESTING FEATURE uncovered during the season's work was the trail of a flesh-eating dinosaur following that of a sauropod. This is seen at the left of Trail Two as a row of three-toed footprints. Made at a time when the mud was of the same consistency, these prints suggest that a fourteen-foot flesh-eater was actually stalking the big quadruped. At any rate, when the sauropod swung to the left, the carnivorous dinosaur did likewise. Along this ancient waterfront, the territory of these two distinctively different types of dinosaurs overlapped

(Below) PREPARATIONS are made to remove the first slab of tracks, 29 feet long by eight feet wide, to be placed under the tail in the base of the Brontosaurus skeleton in the American Museum. Most fortunate circumstance of the entire season was the comparative thinness of the track-bearing layer, which was less than eighteen inches thick. The rock rested on a four-foot bed of soft clay and was not difficult to cut with chisels. The sequence and association of fore and hind foot impressions are typical of the trail made by any slow-moving, very heavy four-footed animal. Later a suitable section of the flesh-eating dinosaur trail was taken



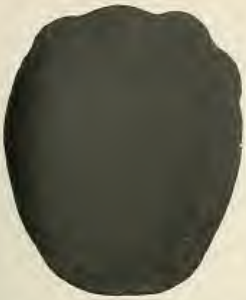


HOW REMOVAL of this 30,000-pound track slab was possible. In addition to the fortunate bed of clay underneath, the block also had convenient cross-fractures which allowed easy blocking off into sections. The edges were then covered with plaster jackets to preserve clean contacts, sections were given numbers, and their relationship recorded on a chart, so that re-assembly would present no problem

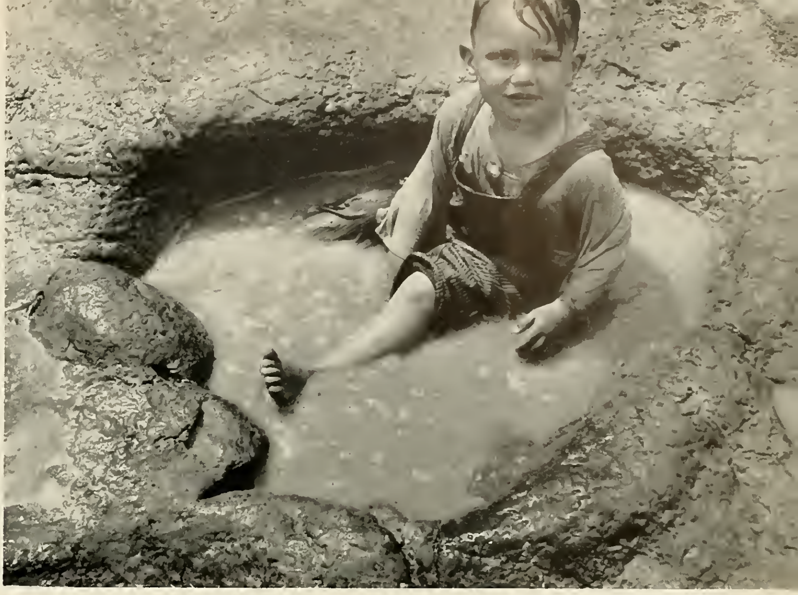
PHOTOGRAPH OF THE PHOTOGRAPHER: the high scaffold "tripod" from which most of the trail pictures were made. In the background below, men are reducing the weight of several sections of slab by chiseling off surplus stone from the underside, preparatory to moving them up a 30-foot river bank where they were to be picked up by truck

AFTER the American Museum specimens were removed, other track slabs were taken for the University of Texas and the U. S. National Museum in Washington. This photograph at right is not a picture of the world's biggest jigsaw puzzle but just a fraction of the 1200-piece, 40-ton collection of tracks being crated for shipment. Materials used on the job included 1500 burlap sacks, 2000 pounds of plaster of Paris, and 8000 Kleenex tissues (to prevent plaster from adhering to track surfaces)

(Left) ONE of the major vicissitudes associated with collecting fossils from a river bed. When the river rose, dikes broke, and the quarry filled with mud. Most exasperating were repeat performances, just after the quarry had been cleaned. This shows the river receding from a typical five-foot rise, of which there were half a dozen during the summer



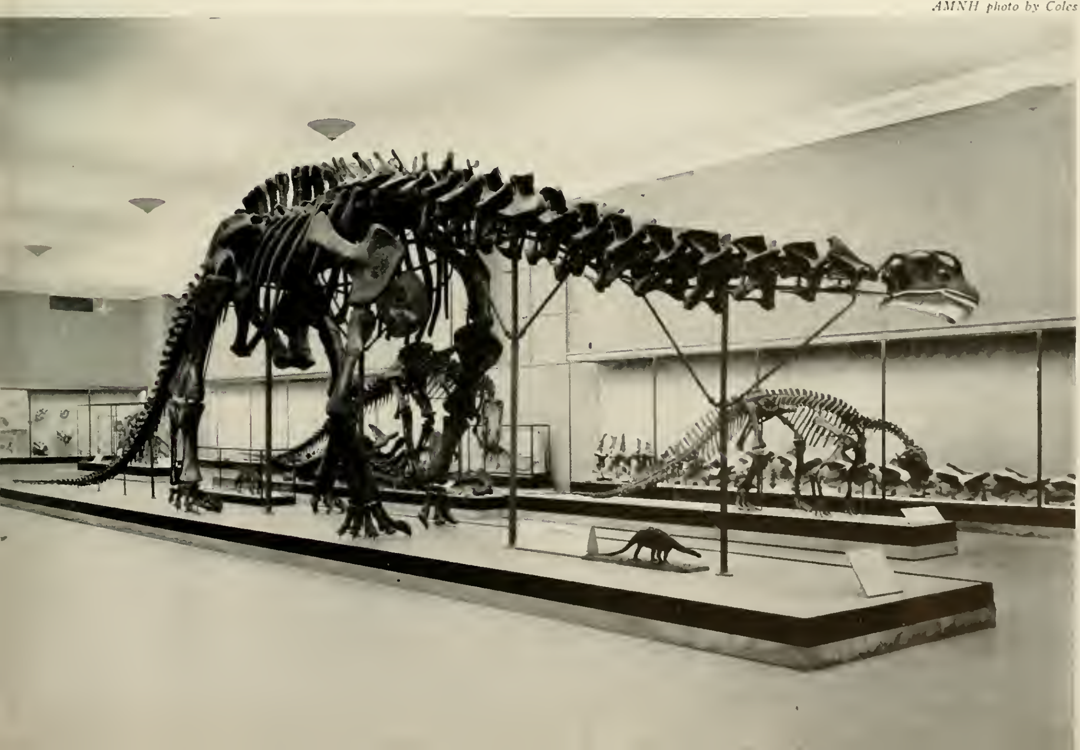
Above is shown the footprint of a large modern elephant reproduced in the same scale for comparison with the dinosaur footprint at right

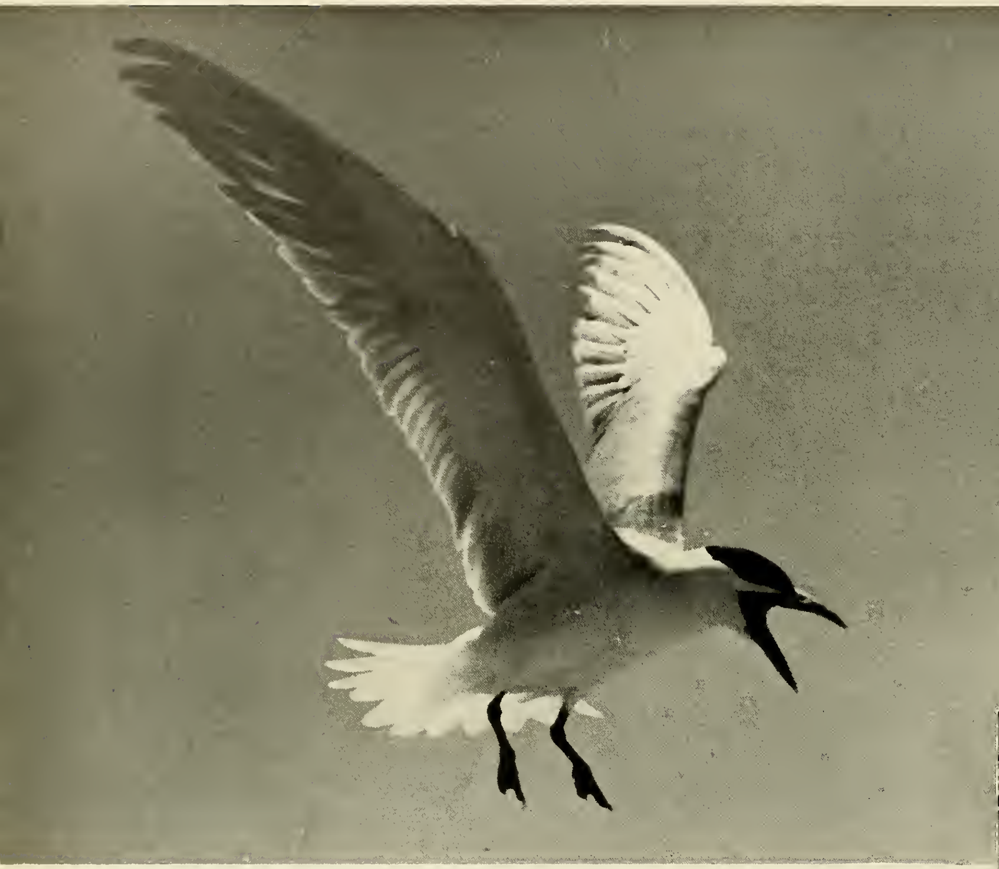


HOW BIG is a big sauropod track? The young man examining this one, even to the point of taking a bath in the crazy thing, is young Tommy Pendley, who just wanted to find out. The footprint held eighteen gallons of water. Hailing from Cleburne, Texas, Tommy was the three-year-old son of one of the men engaged on the project

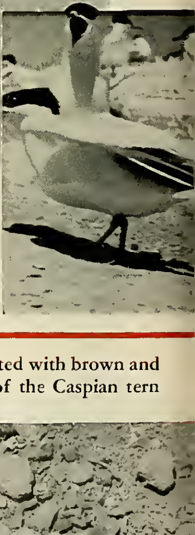
(Below) THE SKELETON of a sauropod, approximately the one which left his footprints in Texas mud: Brontosaurus, under whose tail the footprints will be mounted in the American Museum's new Jurassic Dinosaur Hall. Once living in fresh and brackish water of lakes and lagoons, these creatures floated their huge bulks around in quest of the plants on which they lived, occasionally wading close to shore. That they were sometimes preyed upon by the fierce flesh-eating dinosaurs of the times is known from tooth-scarred bones, as well as from the tracks of a flesh-eater apparently following the trail of one of these huge creatures the whole length of the quarry in the foregoing photographs. The skeleton is over 66 feet long and stands 15 feet high at hips

AMNH photo by Coles

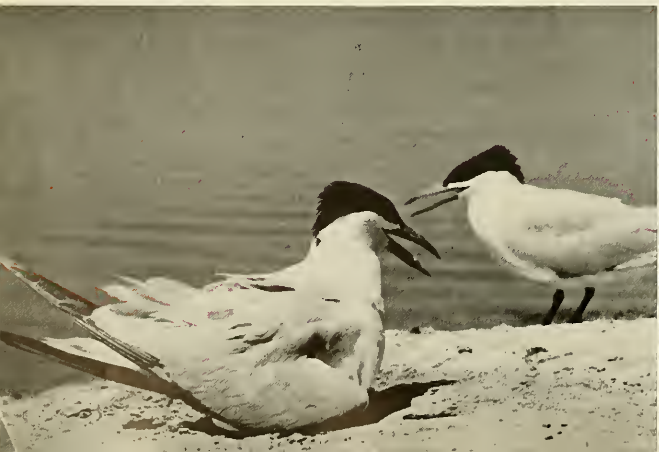




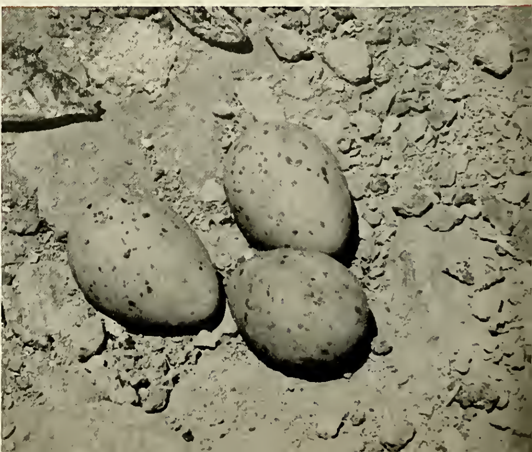
PORTRAIT OF A KING. With wings out-stretched and bill open, this Caspian tern asserts His Birdship's rights in defiance. Almost as big as the common herring gull, the heavily-built Caspian is the largest of all terns. Although its tail is forked, as are those of most terns, the fork is not conspicuous, thus heightening the bird's resemblance to a gull



1 Caspians differ from royal terns in the way the Caspian's wing tips extend beyond the tail when at rest



2 Two or three light buffy eggs spotted with brown and gray make up the normal clutch of the Caspian tern



THE CASPIAN TERN

Sand, sun, and marauding man are a family problem for one of the world's most widely distributed birds

By RICHARD H. POUGH

With illustrations by
MELVIN T. JOHANSEN

KING of all the terns is the nearly cosmopolitan Caspian [*Hydroprogne caspia* (Pallas)]. Ever since the first specimen was recorded in 1770 near the Caspian Sea, this graceful, gull-like creature has gained recognition on every continent save one, South America. Adaptability to both salt and fresh water doubtless helps to determine its wide range. In the Western Hemisphere its breeding colonies are scattered all the way from such northern areas as Great Slave Lake, the coast of Labrador, and the Great Lakes, to the Gulf Coast of Texas; and in the Eastern Hemisphere, south to Cape Province in South Africa and New Zealand. Few birds have so great a range.

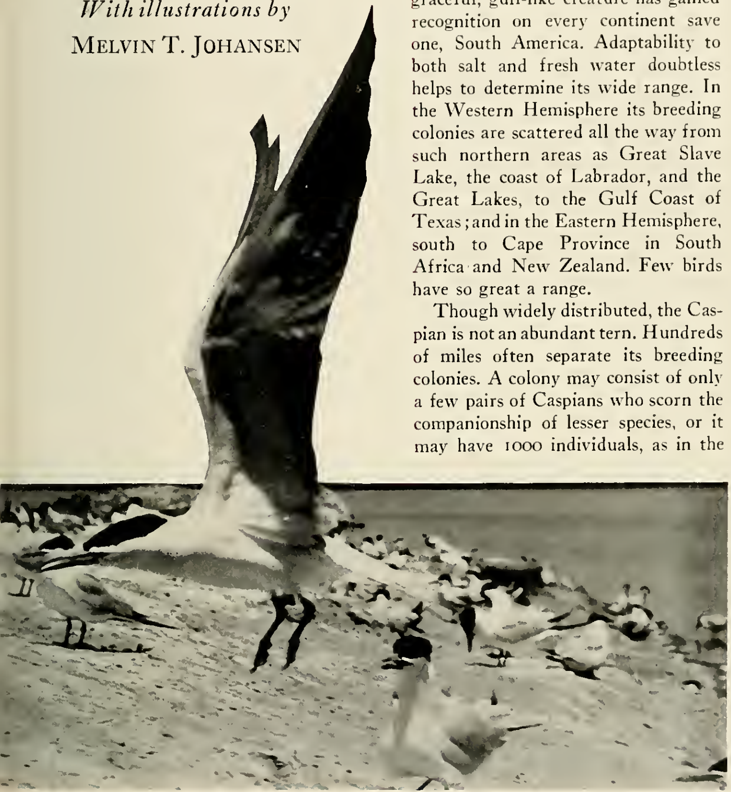
Though widely distributed, the Caspian is not an abundant tern. Hundreds of miles often separate its breeding colonies. A colony may consist of only a few pairs of Caspians who scorn the companionship of lesser species, or it may have 1000 individuals, as in the case of the California ternery shown in the accompanying photographs.

The Caspian's shyness has defied the plumage hunter but has proved no protection to the eggs, an enticing titbit for the marauder but a serious loss to the Caspians, since in certain regions their numbers have been materially reduced. The spotty distribution seems to indicate survival of a more abundant species.

Its effortless, graceful flight carries the bird to northern breeding colonies in eastern and western Canada, and thus the Caspian is at least an occasional migrant on almost every large body of water in the country and along the seacoast. On the South Atlantic and Gulf Coasts, it is considered a permanent resident.

Among the vast hordes of colonizing terns none is larger, stronger, or fiercer than the Caspian. Though resembling the royal tern (in fact, they were confused by so great a naturalist as Audubon), the Caspian's aggressive "individuality" has indeed won him imperial honors in birddom.

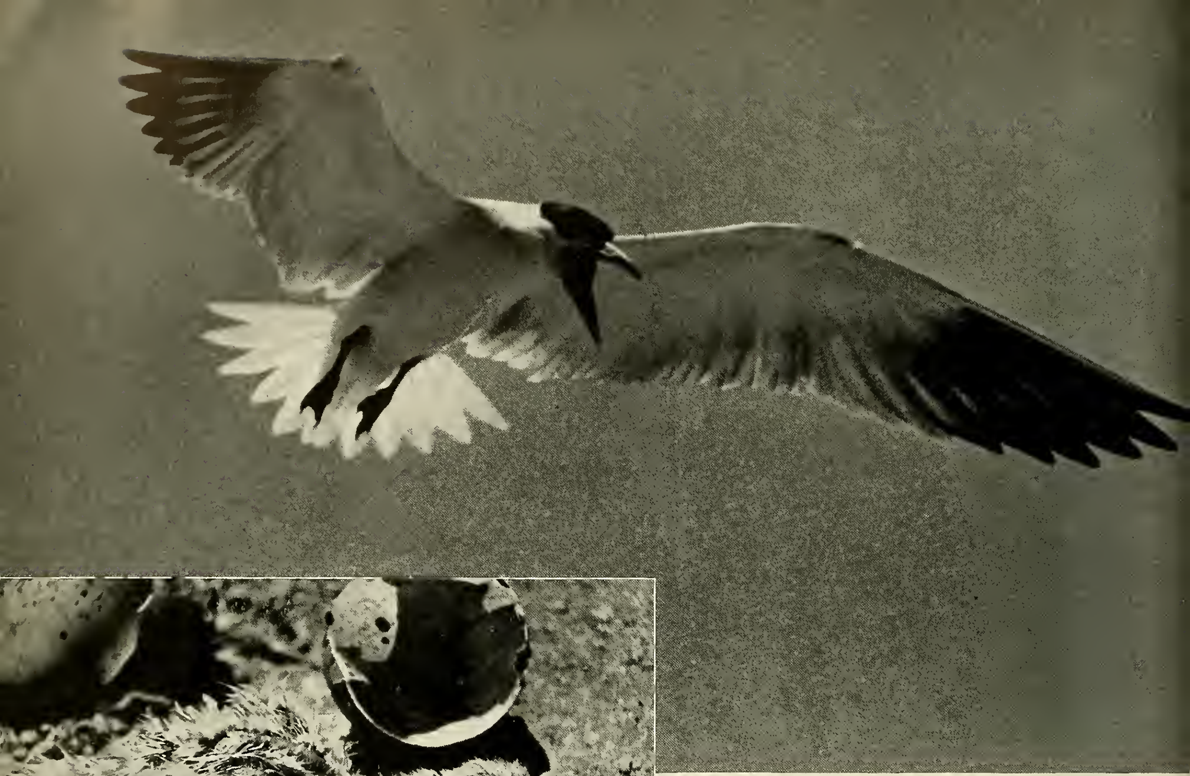
Only one group of Caspian terns, inhabiting Australia and New Zealand, is at present recognized as possibly constituting a separate subspecies.

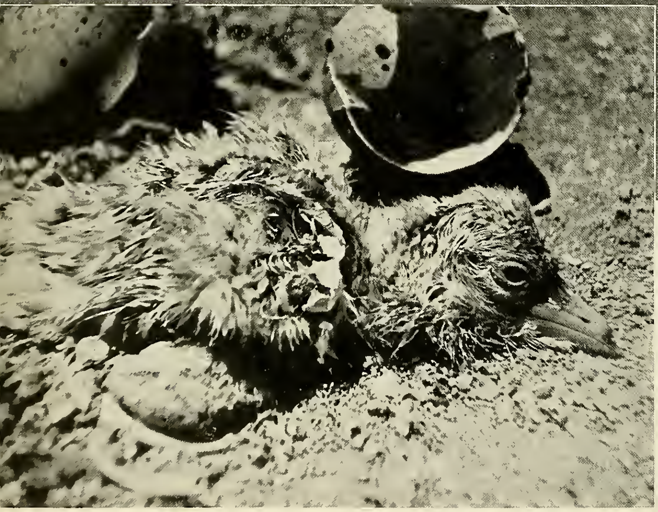


CASPIAN TERN colonies are often associated with those of other sea birds. The nests, closely spaced, form a compact group usually somewhat separated from the main colony

3 Storms and high tides frequently destroy the eggs before the 20-day incubation period is completed

4 Ants can be a serious threat to hatching terns, devouring them before they get out of the shell





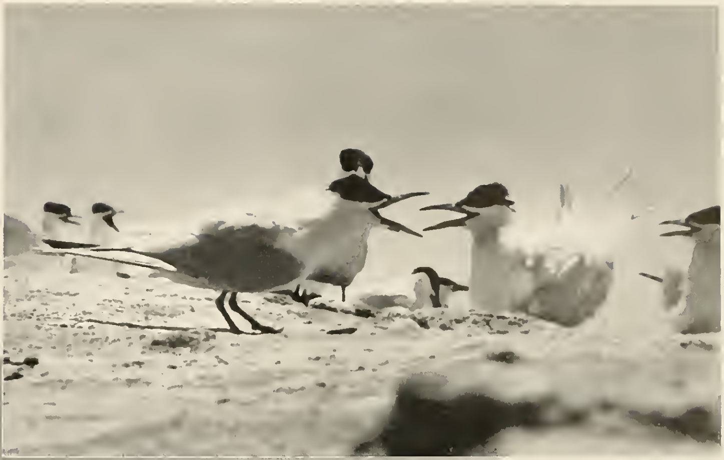
(Above) THE heavy carmine bill is one of the Caspian's most conspicuous field marks. The large amount of dark on the primaries, especially as seen from below, also helps to identify it

5 *(Left)* After the exhausting struggles to free itself from the egg, the young tern lies motionless while its down dries. A strong wind, by blowing sand which sticks to the wet down, sometimes buries a young bird alive at this stage

6 A few hours after hatching, a young tern is a fluffy ball of grayish-white down, spotted with black. Although active, they must beg for their food

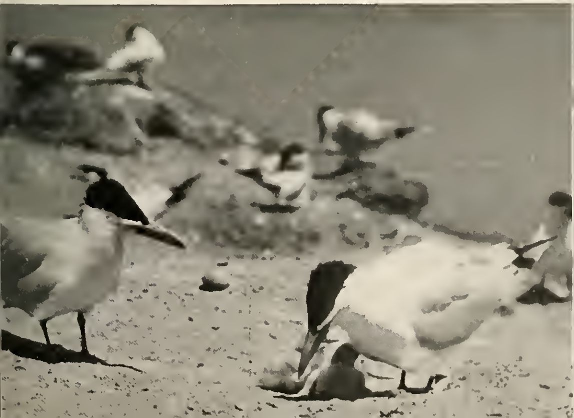
7 The summer sun's rays can quickly kill young terns. Thoughtless onlookers sometimes destroy hundreds of young by preventing the parents from sheltering them

(Right) CLOSE CROWDING of the nests produces numerous territorial clashes between adjoining pairs

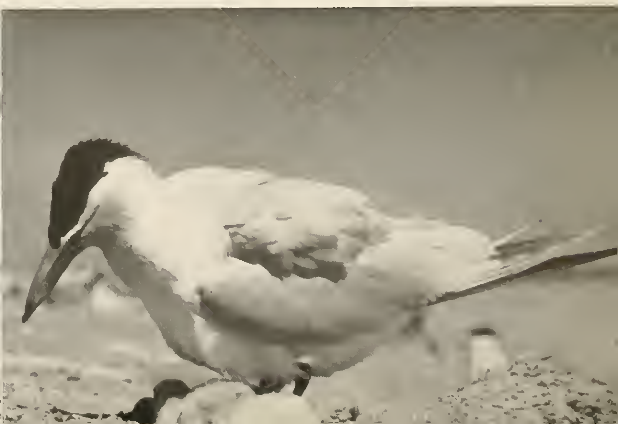


(Left) A TERN COLONY is a continuous bedlam of noise whenever a human is in sight. The note of the Caspian is a very characteristic deep, raucous "ka-arr." Once learned, it enables one instantly to separate the Caspian from other terns

8 Raw rather than predigested fish appear to make up the sole diet of the young. Three- or four-inch fish are swallowed part way and then digested by degrees



9 Terns seem always to know their own offspring, and the young their parents, whose calls they appear to recognize. Toward other young the adults are most brutal



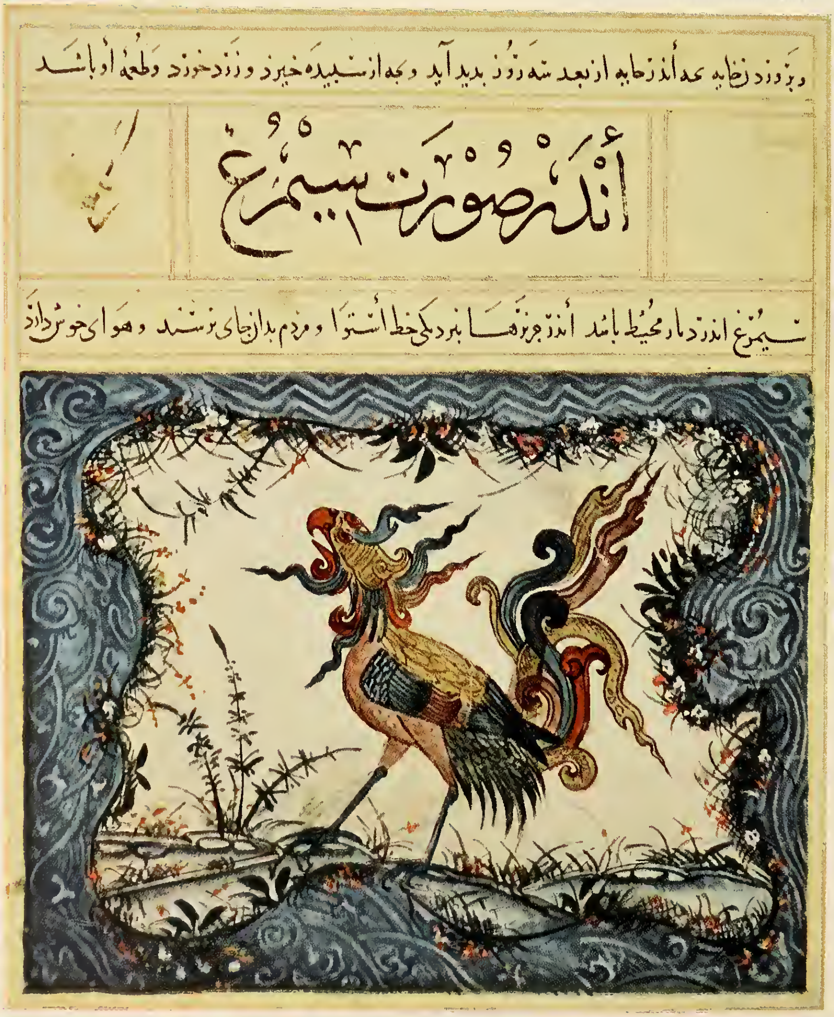
HOW DOST THOU PORTRAY THE SIMURGH?

By GEORGE GAYLORD SIMPSON

Associate Curator of Vertebrate Paleontology
The American Museum of Natural History

BEHOLD THE SIMURGH! Although it dwells "in fastnesses never penetrated by man," its every lineament stands revealed by the imaginative powers of a Persian manuscript-illustrator of the thirteenth century. But later a fellow countryman indignantly penned in the margin of this bestiary, "Thou fool, if nobody has seen the simurgh, then how dost thou portray it?"

Courtesy of the Pierpont Morgan Library


و بزود زهابه بچه اندر زهابه از بعد سه روز پدید آید و بچه از سپیده خیزد و زند خورد و طعمه او باشد
اندر صورت سیمرغ
سیمرغ اندر دمار محیط باشد اندر جزیرها نزدیکی خط استوا و مردم بدان جای نرسند و هوای خوش دارد

Introducing the Story of Animal Art through the Ages

WHAT would you say is the most exclusively human accomplishment and the most indispensable basis of civilization? Ask this question of a group of people and you will receive many answers: foresight—the ability to use tools—speech. These are certainly indispensable and they certainly reach their highest development among humans, but they are not exclusively human and they are not peculiarly associated with progress toward civilization. Ants show foresight. Apes use tools. Birds have a rudimentary sort of speech. The ancestors of the most primitive modern races had all these characteristics nearly as well developed as we do; but their descendants remained savages while other races developed the highest civilization.

This magazine and the museum that publishes it are excellent examples of what seems to me the best answer to my question: the ability to make records, to store up and to communicate any sort of idea or observation beyond the reach of a single voice or the span of a single life. This ability is, indeed, exclusively human; it is shared by all civilized men, and its acquisition by any race leads inevitably to higher cultural levels. Such records are of many sorts. Writing is now by far the most important, but it is not the only method, nor the most ancient and fundamental. The modern museum's presentation of groups and paintings is the highest type yet evolved of another sort of record. The Okapi Group in our Akeley African Hall, for instance, records with perfect fidelity every detail of the appearance of the okapi and of its natural surroundings. It communicates this record to millions of people who have never seen these things and who have never talked to anyone who has seen them. Photographs and paintings, like those reproduced and circulated by the Museum through NATURAL HISTORY Magazine, achieve the same end in less vivid but more distributable form. Such accomplishments have extremely ancient origins, long before Rome or Babylon, and they are the result of a long and fascinating history.

The earliest known human records are pictures of animals. The cave men of ancient France painted on rock walls, scratched on bone, and modeled in clay pictures of their favorite animals: horses, deer, mammoths, bison, and others. These animals were their favorites because they were good to eat. As the cave man recorded his menu on the walls of his cave, he was unconsciously communicating to us his observations on the creatures of his day. In some cases, particularly the mammoth and the woolly rhinoceros, we know through his drawings what an animal now long extinct looked like to an eyewitness.

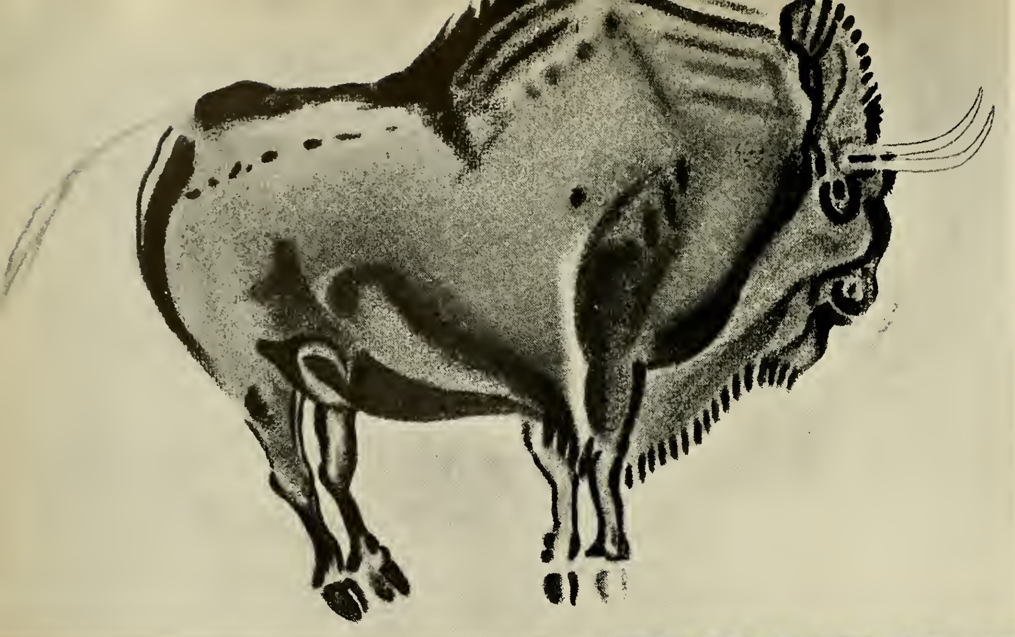
Such communication of observations is the essence of scientific illustration, and the cave man might be called the first scientific illustrator, except that this was not his intention. He had in surprisingly high degree the other two requirements of scientific illustration: firsthand observation of the object, and technical skill in recording it. The cave man did not make his drawings for the purpose of showing anyone what the animal looked like. He cannot have foreseen nor have been concerned with our appreciation, and his contemporaries had seen the animals for themselves and knew what they looked like as well as he did. Probably he sometimes painted or engraved just for fun and for truly artistic motives of aesthetic expression, but it is believed that the usual purpose was magical.

> Although it covers much material not represented in that collection, this article is written with special reference to the Pierpont Morgan Library and to its exhibition, "The Animal Kingdom," open until February 28, 1941. Indebtedness to the excellent catalogue by Helen M. Franc and to the thoughtful arrangement and enlightening labels of the exhibition is gratefully acknowledged.

The Old Stone Age representations of animals seem to have been associated with rites or beliefs to promote the increase of game animals and success in hunting them. This would explain why the animals well portrayed are almost always those that were common articles of diet. Representations of animals less often eaten, or of men, are relatively rare and crude in this most ancient art. It would also explain why the cave paintings are commonly hidden away in places where they can hardly have been intended to be seen often and admired by the mob. In a sense these decorated caves were neither natural history museums nor art galleries but churches. The association of animal art with religion, far antedating its association with science, has continued through every age, including our own, and through almost every system of religion, including Christianity.

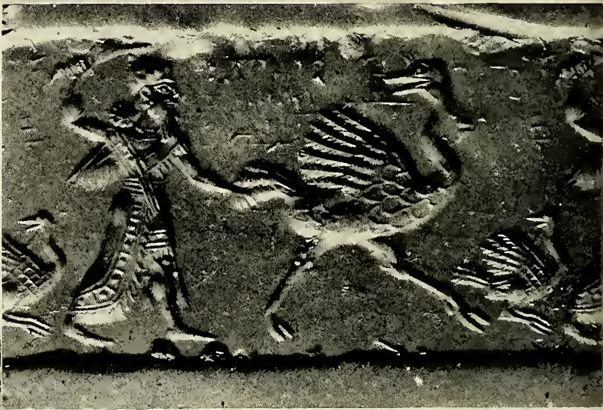
The urge to draw pictures has never abated, and animals, the first subjects, have always been favorite models. It was this urge that led directly to the invention of writing. Drawing a picture of a thing is as good as saying its name. In fact it is better, because the picture can be sent to great distances and can be handed down to posterity. The pictures can be simplified so that they become symbols quickly written. They can be systematized and generalized so that they can express not only concrete objects, but also all sorts of ideas, indeed, all the words or sounds of a language.

Many of the early pictures that later evolved into true writing were pictures of animals, and some of the letters of our alphabet had this origin. According to one theory, disputed but not improbable, *A* was once a picture of an eagle, *B* of a crane, *F* of a horned viper, *L* of a lion, *M* of an owl, and *Z* of a duck. If its letters returned to their original forms, this sentence would resemble a zoo! The animal symbols in the earliest writing, particularly the Egyptian hieroglyphs, were often excellent portraits, but they

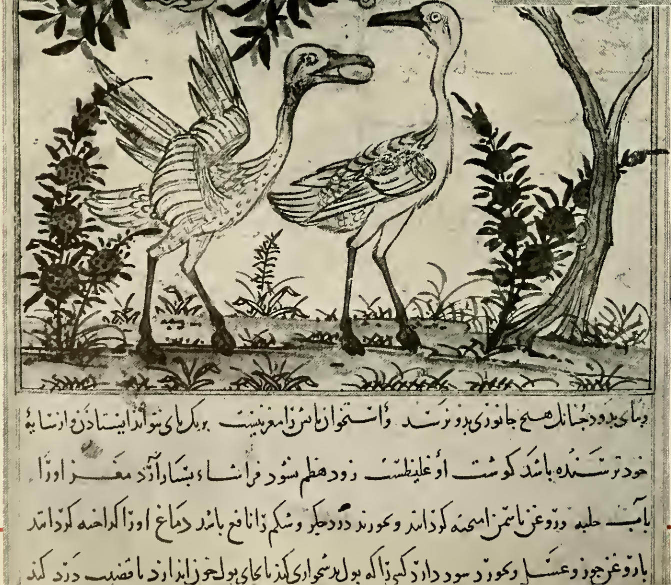


AMNH photo by Thane Bierwert

UNTOLD CENTURIES before the imaginative artist created the simurgh illustrated on the title page of this article, an anonymous cave man in prehistoric Spain daubed the remarkable likeness of a bison, shown above, upon a rock wall. His portraiture is excellent because it is not imaginary. He had seen the bison many times, and eaten him. His painted caves were probably churches rather than art galleries. The animal pictures served in magical rites calculated to increase the supply of game and bring good luck to the hunters. (Polychrome bison at Altamira, Spain, reproduced from *Cave of Altamira . . .* by Abbé Breuil and Hugo Obermaier)



Courtesy of the Pierpont Morgan Library
Seal reproduced from on impression
by Edith von Porada

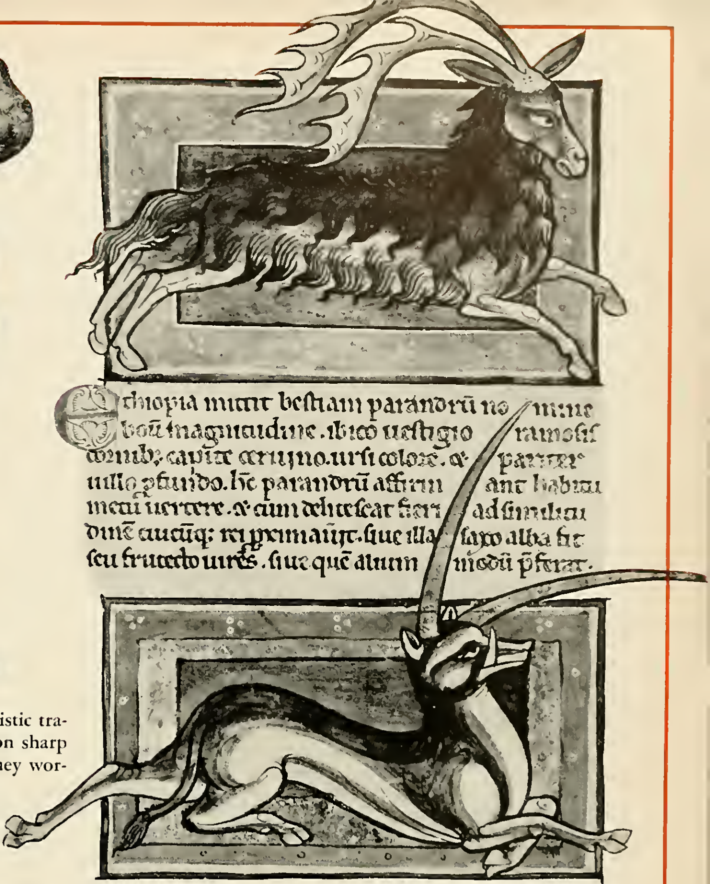


وپای بدود چنانك هیچ جانوری بدو نرسد. و استخوان پاش را مغز نیست. بیک پای نتواند ایستادن و از سایهٔ
خود ترسنده باشد گوشت او غلیظست زود هضم شود فراشا بسیار آرد مغز او را
با آب حلبه و روغن یاسمن آمیخته کرده باشد و بخورند درد جگر و شکم را نافع باشد دماغ او را کراخه کرده اند
با روغن جوز و عسل و بخورد سود دارد کسی را که بول بدشواری کند یا جای بول حرز ابزارد یا قضیب درد کند

THE ASSYRIAN artist who engraved the hunting scene above on one of the famous Babylonian seals knew his ostriches; the bird is a good, recognizable portrait. But the illustration at left is not. The latter is the work of the Persian creator of the simurgh, who had never seen an ostrich, either. Nothing daunted, he drew a crane with two toes, labeled it "ostrich," and went on his way rejoicing

Courtesy of the Metropolitan Museum of Art

THE ANCIENT EGYPTIANS created a realistic tradition in animal art that was soundly based on sharp observation. Their sculptures of cats, which they worshiped, have never been surpassed. Indeed, they depicted every animal known to them with such skill that the exact species represented can almost invariably be identified



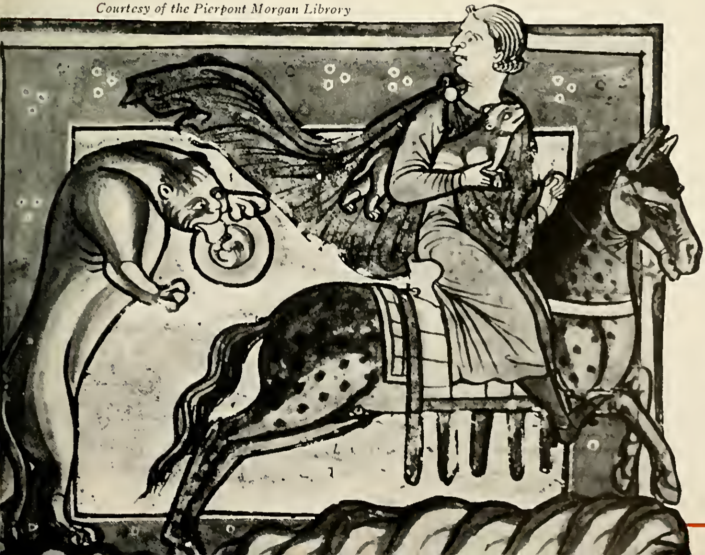
Ethiopia mittit bestiam parandrū no mine
boū magnitudine. bisulco uestigio ramosis
cornib; capite ceruino. ursi colore. & pariter
uillo ꝓfundo. hūc parandrū affirm ant habitū
metu uertere. & cum delitescat fieri ad similitu
dinē cuicūq; rei ꝓximaūit. siue illa saxo alba sit
seu frutecto uirēs. siue quē aliud modū ꝑferat.

Courtesy of the Pierpont Morgan Library

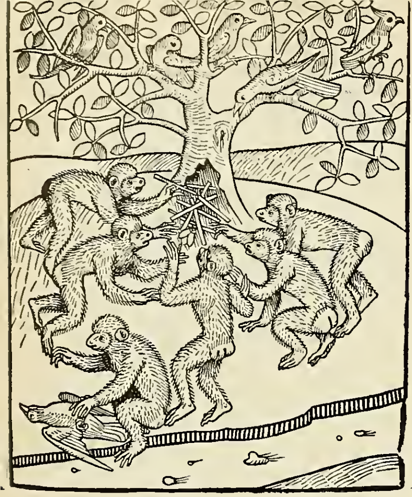
(*Above*) THE PARANDRUS AND THE YALE. The parandrus is described as "an antlered stag, who like the chameleon can change color according to the environment as the need arises." And the yale, far from the bulldog which the name calls to mind today, was a sort of antelope having swivel-mounted horns that could be pointed in any direction at will. Both animals are from an English bestiary, or "Moralized Natural History," produced in the second half of the twelfth century

WITH THE COMING of the Medieval Age, animal art declined sharply both in Europe and the Orient. Two great religions turned the eyes of men toward worlds other than the one in which they lived, Christianity and Islam. The latter word means "submission," and this trait in many ways characterized the medieval followers of Christ as well as Mohammed. They believed in authority, not observation. Fidelity to nature was forgotten, and animal artists were interested only in turning out moral symbols

Courtesy of the Pierpont Morgan Library

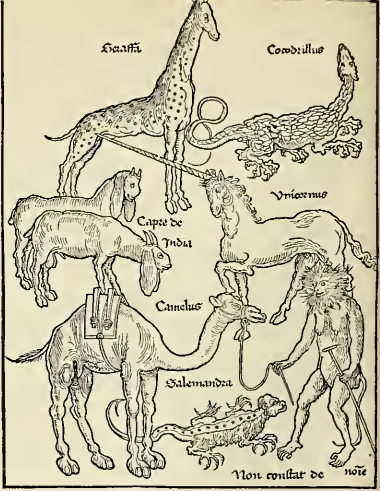


THE MORAL ADAPTATION of animal lore is clearly shown in the scene at left, depicting a hunter stealing the cub of a tigress. To forestall pursuit he has tossed her a mirror. She is shown licking the image, believing it to be her lost child. The cub is your soul. The hunter, the devil. The mirror represents worldly pleasures. As storytelling, it is excellent; as anatomy, atrocious. Under this moralistic aegis, mythical animals were conjured up on every side



APES AND GLOWWORM. A startling item of natural history appears at left. The original caption for this fifteenth century woodcut is repeated here without comment, "A party of apes, becoming very cold in the high mountains, caught a glowworm and tried to kindle a fire by its light. Their unsuccessful efforts were derided by the birds, which so irritated the apes that they began to strangle the birds." (From the *Directorium Humanae Vitae,* printed at Ulm in 1483)

Courtesy of the Pierpont Morgan Library



were not scientific illustrations or the antecedents of these. They were meant to convey the name of the animal—and later a language sound without reference to the animal—but not its appearance. This communication could be made just as well, and much more quickly, without making a careful portrait, and so the pictorial qualities eventually were lost and simpler symbols evolved that retain no hint of their animal origin.

The Egyptians and other ancient peoples of the eastern Mediterranean delighted and excelled in animal portraiture aside from animal-writing. Their art abounds not only in animal gods and mythical creatures, but also in naturalistic studies of real animals that are both artistic and accurate. Probably no one has excelled the Egyptians in portraying cats or the Greeks in portraying horses. Since the Egyptians were particularly fond of drawing animals, it is hard to find any considerable Egyptian painting or relief that does not contain an animal of some kind. With such skill did they make pictures of practically every animal, wild or domestic, known to the ancients, that the exact race or species represented can almost invariably be identified. They even anticipated that great stimulus to animal art in later days, the foreign expedition, for they, too, drew pictures of the men and animals of distant regions to show what they were like.

Except for supernatural beings frankly represented as such—sphinxes, jackal-headed gods, and the like—Egyptian representations of animals are obviously drawn from life with faithful attention to detail. They represent a high point in the history of animal art and a scientific tradition that was later lost, not to be recovered until almost our own days.

A distinction can be drawn between animal art like that of the Egyptians, who depicted animals accurately from models, and the work of artists whose animals were often figments of the imagination, even when presented as sober truth. Two examples in the Morgan Library's current exhibition, "The Animal Kingdom," illustrate the distinction excellently. A late Assyrian seal of the eighth century B.C. shows an ostrich, stylized in keeping with its purpose but anatomically correct and immediately recognizable. The artist certainly knew exactly what an ostrich looks like and how to draw it. In contrast with this, the Persian illustrator of a thirteenth century A.D. bestiary evidently knew nothing of the ostrich except that it was a bird with long legs and neck and two toes. Nothing daunted by the fact that he had never seen an ostrich, he drew a crane with two toes, labeled it "ostrich," and went on his way rejoicing. The same artist revealed the same defect when he came to the hippopotamus, an animal excellently portrayed by the Egyptians many centuries earlier. He knew the name, which means "river horse," and apparently also had the information that it differs from the true horse in having a shorter tail and more than one hoof on each foot. His picture of the hippopotamus shows an ordinary horse, Dobbin with a Persian accent, with a short tail and cloven hoofs like a cow's standing in a river!

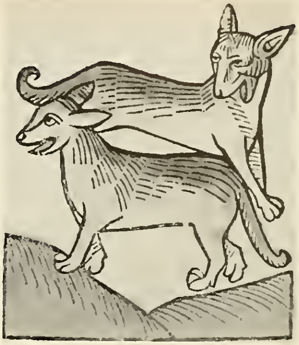
This Persian book nevertheless is representative of the best scientific animal illustration of its day. It was painted in Maragha sometime around 1295. The text, translated from the Arabic for Ghazan Khan, consists of descriptions of the animals and their habits, in large part ultimately derived from Aristotle, followed by what were believed to be their uses, especially in medicine. We would call such a work a treatise on economic zoology, but in the Middle Ages it was called a bestiary.

The medical recipes of this book range from the sublime to the ridiculous. Recommendation of a bit of dragon skin to kill moth eggs runs the whole gamut in itself and is passed on for the benefit of harassed housewives. At the other extreme, the statement that burned oyster shell rubbed on the teeth will whiten them is both true and practical. Carrying a hyena's tooth to improve the memory is practical if not true.

The descriptions of the animals are hardly more realistic than the prescriptions. The bone in the lion's neck is said to be one solid piece so that the creature cannot turn its head. The giraffe is said to have no joints in its front legs. The bear is said to grow so fat from not eating all winter that it can hardly get out of its cave in the spring. The ox is said to cast its horns once a year like a stag. Many of these bits of zoological misinformation pose logical questions suitable for a game of "What is wrong with this statement?" A good example to ponder is this Persian

WHEN TRAVELERS like Marco Polo voyaged afar to see the real animals, observation began slowly to come back into its own. The illustration at left is from a book, *Pilgrimages in the Holy Land,* printed in Germany in 1486. The artist guarantees the beasts to be "truly depicted as actually seen by us." But, though the long-eared goat and camel do show sound observation, the astonishing monkey and the unicorn mark this as a work of the transition period

THE INVENTION of printing helped immeasurably to spread the idea of observation among animal painters. The woodcut of wolves at right illustrated *The Garden of Health,* originally printed in 1485. Crude in artistic effect, these animals were nevertheless drawn from life, and the book ranks among the first natural histories in the modern sense



Courtesy of the Pierpont Morgan Library

author's belief that a female elephant can have only one offspring in the course of her whole life.

"The mountain goat," says the author (probably referring to the ibex in this instance), "leaps down from high places and lands unharmed standing on his horns. He breathes through his perforated horns; if the holes are stopped up, he shortly dies. The number of joints in his horn corresponds to the number of years of his age. He takes care of the female by bringing her grass and water in his mouth." The chestnut about the goat—or often a sheep—that lands unhurt on its horns is still a living bit of folklore and is solemnly repeated every summer to tourists in the Rocky Mountains.

The artist did not fall into the author's mistake about the animal's mode of breathing for he drew it with imperforate horns and normal nostrils. Indeed the artist in general was incomparably in advance of the text scientifically because, as a rule, he had bothered to look at the animals, and the author evidently had not. For his time, this was a remarkably realistic attitude, for since the days of the Egyptians and the Greeks few men had taken the trouble to look at nature. This anonymous but excellent artist made competent, recognizable paintings of all the animals accessible to him. Still more surprising, and a step ahead of much of the otherwise superior ancient work, is the fact that he has placed most of the animals in natural surroundings. These are among the first habitat paintings, lineal ancestors of the Museum's habitat groups. Only when the text calls for an animal for which the artist could not possibly obtain a model does he go astray, as in the ostrich and hippopotamus already mentioned.

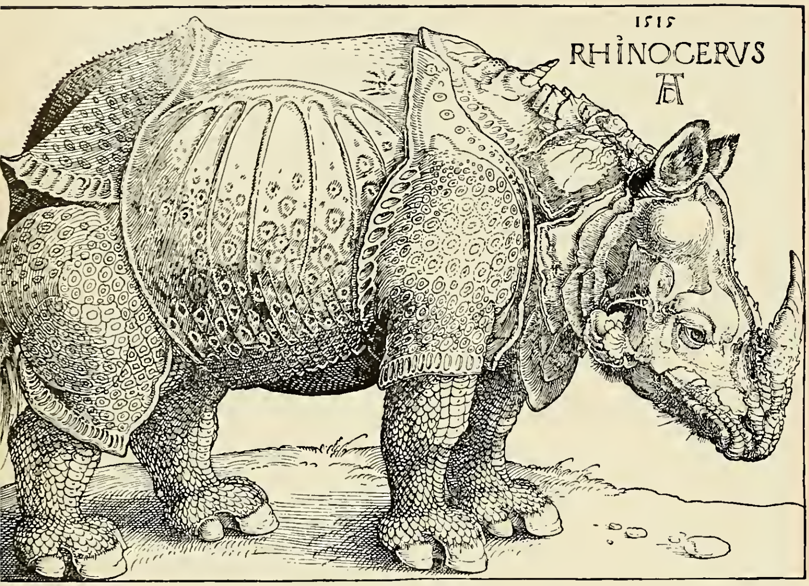
In a few cases the text describes an animal that was completely imaginary, as this careful artist must well have known. One can see him shrugging his shoulders and saying in medieval Persian, "Oh, well, let's shoot the works!" The result is his dazzling picture of the simurgh, a wonderful beast that lives (so the less critical author assures us) in fastnesses never penetrated by man. An owner of the manuscript, even more a scientist than the artist, has jotted in the margin, in the beautiful Persian script, "Thou fool, if nobody has seen the simurgh, then how dost thou portray it?" This marginal note by an unknown skeptic, long dead, should be framed and kept constantly in view by everyone who aspires to be an animal artist. The first and last essential of scientific animal portraiture is to see the animal.

That one must see an animal in order to portray it was well known to the cave men, to the Egyptians, Assyrians, and Greeks, but it was forgotten by the medieval Europeans. They believed in authority, not in observation and reason. They studied nature in books, not in fields and forests. Most students were not merely unscientific, but anti-scientific. The European bestiaries of that period show that there was no science of animal portraiture.

A typical example, and one of the most attractive artistically, is the Morgan Library bestiary in Latin, painted and written in England in the second half of the twelfth century. The text is for the most part an adaptation of a Greek text of ten centuries earlier, which in turn was a hash of Aristotle, folklore, and superstition. The purpose is not to describe animals and their uses, like the relatively scientific Arabic and Persian bestiaries of about the same time, but to point a moral. A tigress, for instance, is bereft of her cubs by a hunter who drops a mirror as he flees. The tigress thinks her reflection is a cub and she fondles the mirror while the hunter escapes with the real cubs. The hunter is the devil and the mirror is the worldly pleasure with which he beguiles us while he makes off with our souls.

From a scientific point of view, the illustrations are on as low a level as the text. The artist seldom gives any evidence of having seen the animals that he paints and never shows any concern for fidelity to nature. Many of his animals are figments of the imagination: the centaur, the unicorn, the leucrotta, the phoenix, the halcyon, and the cinomolgus. Here is the parandrus, a sort of horse-hoofed deer that changes its color at will, and the yale, which is not a bulldog but an antelope with swivel-mounted horns that can be pointed forward or backward voluntarily.

Many of these mythical beasts started out as real animals, and their transformation shows how little both artists and authors knew or cared for reality. The tiger, for instance, in one guise was called *martichoras,* a corruption of the Persian "man-eater," later still further corrupted to the manticore

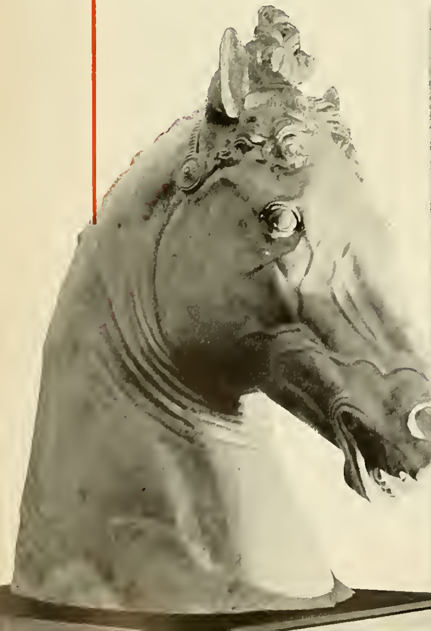


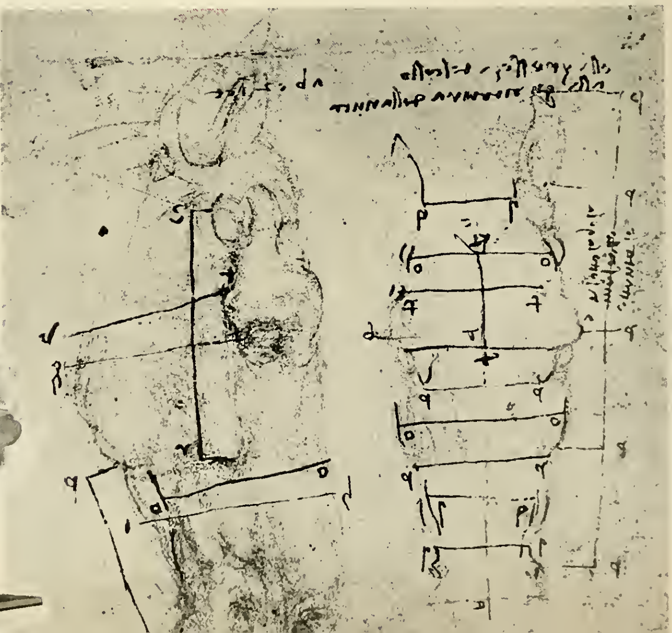
THE RENAISSANCE saw the rise of menageries in princely courts. These importations enabled artists to portray exotic animals in a realistic manner. An interesting result of this fresh stimulation is the rhinoceros at left, drawn in 1515 by the German painter and engraver, Albrecht Dürer. The animal was the first of its kind to be brought to Europe (Portugal). Dürer did not see it, but while the rhino was in Lisbon a friend of his made a sketch and wrote a brief description, on the basis of which Dürer made his woodcut. Consequently, the outline and proportions are correct. But the skin, which he draws as if it were jointed armor plate with overlapping scales on the legs, betrays the fact that the artist never saw the creature in the flesh

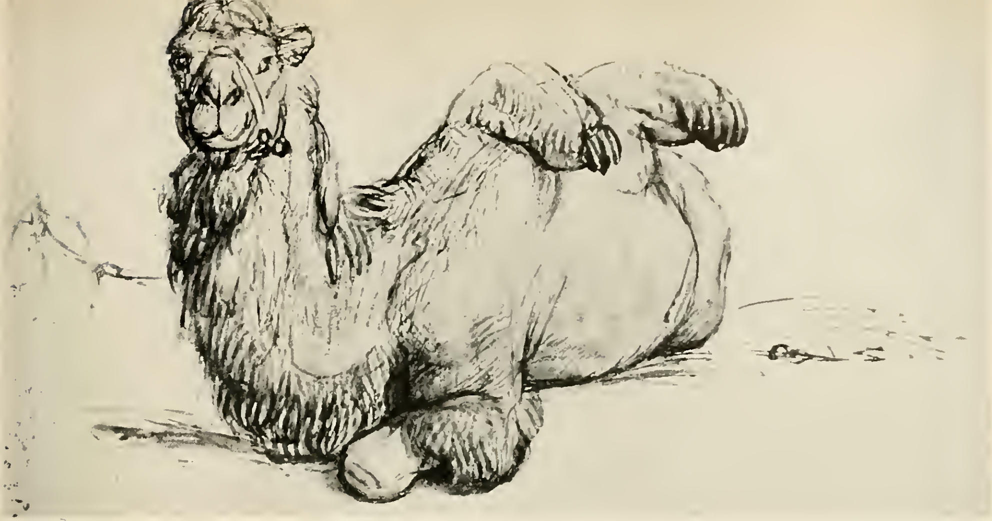
Courtesy of the Metropolitan Museum of Art

THE WORK of Leonardo da Vinci (1452-1519) showed a return to the high standards of the Greeks and helped to usher in the modern period in animal art by combining personal observation, scientific accuracy, and artistic expression. His sketches, like those at right below, show how carefully he studied every detail of the anatomy and proportions of horses. Such studies resulted in triumphs of animal portraiture during the Renaissance, like the fine head modeled by Leonardo's teacher, Verrochio, and cast by Leopardi, shown below at left. This is part of the heroic equestrian statue of Bartolommeo Colleoni in Venice. Typical of much of the work of the period is the fact that the horse is only part of a larger composition in which a human figure dominates. The accurate portraiture of an animal for its own sake was still uncommon

Courtesy of the Museum of Science and Industry



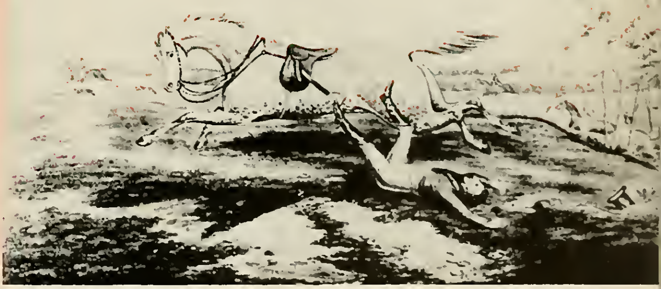




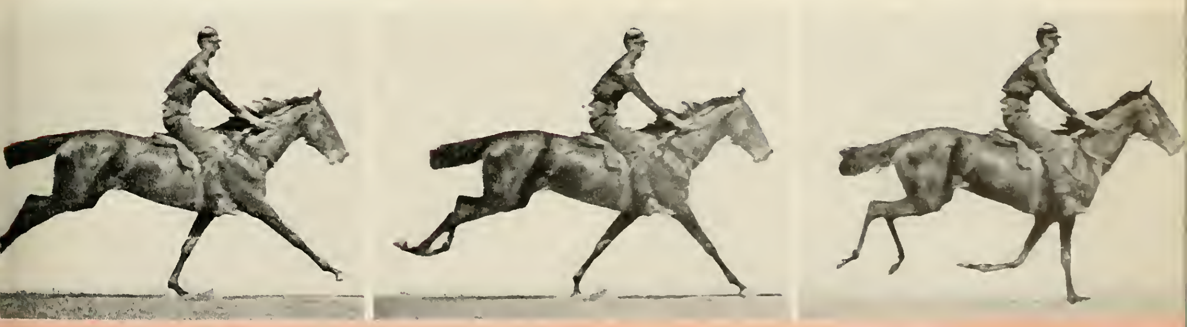
Courtesy of the Pierpont Morgan Library

THIS SKETCH of a camel by the immortal Rembrandt van Rijn (1606-1669) shows what a great artist can do when exotic animals are accessible in zoological gardens. Scientific animal drawing and painting was now on the track which carried it to its present status, as an art which is practiced by an increasing number of people and enjoyed ever more widely through development of techniques of printing. Even in Rembrandt's time and long after, however, animal art was lacking in one thing vital to the portrayal of animals as they are,—a knowledge of the animal's posture when it is in rapid motion

THE DETAILS OF RAPID MOTION often escaped the eye of even the most careful artist, as can be seen in the Currier and Ives print at right. Note that the horse is represented with all four hoofs off the ground at the moment of greatest stretch. This is altogether wrong, although many persons familiar with horses might argue that they have seen it. It remained for Eadweard Muybridge to correct many of the fallacies concerning animals in motion, in his classic book containing many photographic series, one of which is reproduced below. The older drawings were artistically valid in conveying the feeling of rapid motion in a single still picture. Perhaps they did this more successfully than does any one of a series of photographs, but they were impressionistic rather than realistic. The high-speed photographs reveal the scientific facts, and from them the modern animal painter has learned the postures actually assumed by animals at a given instant



From Animals in Motion, *by Eadweard Muybridge*



of the bestiary. It is transformed into a blood-red creature having a man's head (containing three rows of teeth), a lion's body, and a tail ending in a scorpion's sting. Even when the animals bear real names their paintings are often purely imaginary. Thus the crocodile, entirely unknown to the artist as a real animal, becomes a monstrosity with a dog-like head, bird's feet, and a saw-like row of spines on its back. The text assures us that this creature incontinently devours a man and spends the rest of its life in mourning for its victim. Of course this is introduced to point the lesson of hypocrisy.

The drawings in the European bestiaries are often spirited and amusing and they well account for the popularity of such works. In entertainment value they are almost on a par with the delightful illustrations of *The Wizard of Oz* in our day, and their serious scientific value is about the same.

A slow change for the better in European animal art began to appear toward the close of the Middle Ages and during the Renaissance. The first influence in this change was increased travel and exploration. Men who had seen crocodiles at firsthand were not satisfied with entirely imaginary drawings labeled "crocodile." It is true that at first the animals of travelers' tales were likely to be as fantastic as any in a medieval bestiary. The most popular travel book of the fifteenth and sixteenth centuries was that supposedly by Sir John Mandeville (even the author's name was false), which embellished a minimum of personal experience with a wealth of nonsense compiled from the least reliable parts of a large number of unreliable sources. The pseudo-Mandeville's description of the hippopotamus, for instance, is not designed to check the imagination of the artist:

"In this land there are ypotains [hippopotamuses] that dwel sometime on land, sometime on water, and are halfe a man and halfe a horse, and they eat not [naught] but men, when they may get them."

"Mandeville" not only thus made real animals monstrous but also solemnly confirmed the reality of mythical monsters like the griffin with "the body before as an Egle and behind as a Lyon, and it is trouth, for they be made so." People readily give a reputation for truth to a man who repeats familiar lies and will call a man a liar if he speaks unfamiliar truth. "Mandeville" was acclaimed for confirming erroneous beliefs about the East, while Marco Polo's name became almost a synonym for unreliability because he told, with general accuracy and restraint, what the East was really like. He mentions griffins and other fabulous animals, but with the careful statement that he, himself, had not seen them, and what he did see he related truthfully. For instance the giraffe, to Marco Polo, "is a handsome beast. The body is well-proportioned, the fore-legs long and high, the hind-legs short, the neck very long, the head small, and in its manners it is gentle. Its prevailing color is light, with circular reddish spots. Its neck, including the head, is three paces." These are the words of a man who was trying, albeit a little clumsily, to give a true account.

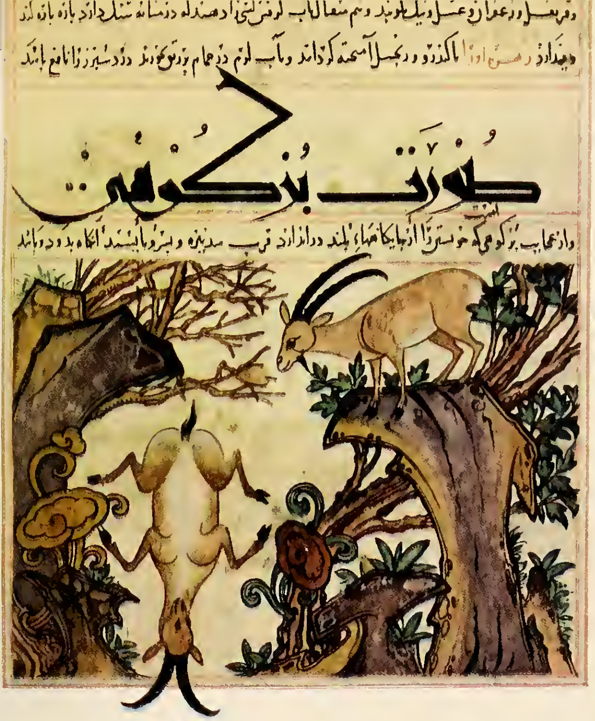
Travelers did eventually become acquainted with most of the real animals that had been only names to Europeans, and they did slowly reach the conviction that the griffin and other mythical creatures were nowhere to be found. Other important factors in the improvement of animal art were the rediscovery of ancient art and a great change in the attitude toward learning and its illustration—realization that "thou canst not portray the simurgh" without seeing it. The close observation and brilliant technique of Greek sculptures of animals inspired the artists of the Renaissance to follow the same methods. An awakened spirit of inquiry, stimulated by Arabic science among other things, led to the desire to draw animals as they really are and for the purpose of conveying accurate knowledge. In short, true scientific illustration of natural history began to appear in Europe for the first time.

The beginning of this new era almost coincided with the invention of printing, which helped greatly to spread the new methods and their results. Some of the earliest printed books included pictures and descriptions of animals. A landmark in this new development is the *Hortus Sanitatis* ("Garden of Health") printed at Mainz by Peter Schöffer in 1485 (a fine copy is now on exhibition at the Morgan Library). Its woodcuts are crude and cannot compare with a good bestiary in artistic effect, but they were evidently drawn from life and they are serious efforts to show the readers what the animals really looked like. A later edition (1491) greatly increased the number of animal portraits and deserves to be ranked among the first illustrated natural histories in a modern sense.

The same happy tendency and its limitations are shown in books of travel of this later period, after Mandeville and Marco Polo, such as Breydenbach's *Peregrinationes in Terram Sanctam* ("Pilgrimages in the Holy Land"), printed at Mainz in 1486. An artist, Erhard Reuwich of Utrecht, accompanied the author and made drawings of exotic animals from life, "truly depicted as actually seen by us." His claim must be true for the camel and long-eared goat. His giraffe and crocodile inspire less faith in his actually having seen the animals, but are recognizable and far better than most of the previous European illustrations of these animals. The monkey (not "ape"), whose name he did not know, may be from life but if so is poorly drawn, and his boast of complete veracity is violently contradicted by the inclusion of a unicorn!

While artists like Reuwich were beginning to go to the animals to study them, the animals were also being brought to the artists. The Renaissance saw the rise of menageries or zoological gardens at many places in Europe, and the princes of the period often had collections of live animals, portraits of which became increasingly frequent in the work of the best artists. Perhaps the best known of these is Dürer's woodcut of a rhinoceros, although it happens to be a belated example of imperfectly scientific animal art. The model, said to have been the first rhinoceros ever seen in Europe, was imported from India by King Emanuel of Portugal, in May, 1513. The animal was intended as a gift for the Pope, but it perished in a shipwreck. Dürer did not see it, but while it was in Lisbon a friend of his made a sketch and wrote a description, the quality of which can be judged from the text published with the woodcut:

"It has a color like a speckled turtle and is strongly enclosed in a thick shell and is as big as an elephant

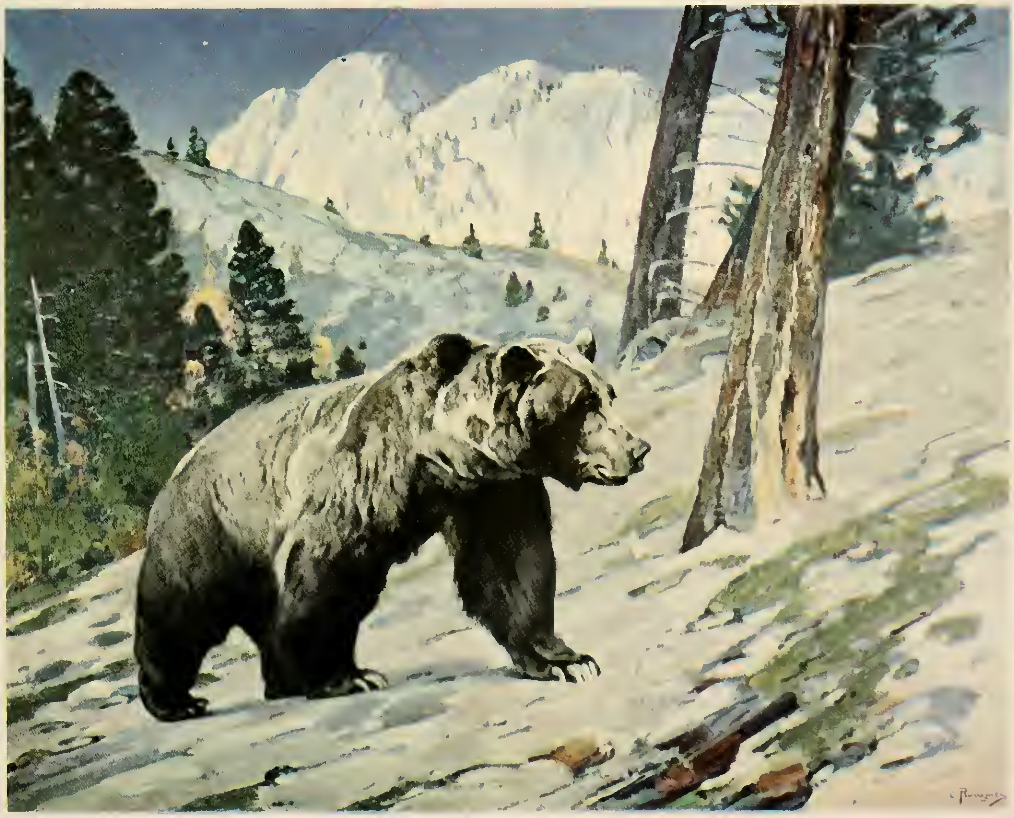


Courtesy of the Pierpont Morgan Library

INCORRECT ANIMAL ART is to blame for the perpetuation of many false ideas. The artist of the Persian bestiary from which the illustration at left is taken, drew the animals with reasonable accuracy. But he forsook his powers of observation when he succumbed to the picturesque notion that the ibex and the mountain goat fall unharmed on their horns, —a superstition that still persists in some quarters today. Through the centuries, with occasional setbacks, the purpose of the animal artist has grown stronger to reproduce nature as it is, to portray the wonders of life in all their real grace and beauty

AS AN EXAMPLE of the highest type of artistic realism in the portrayal of animals, Carl Rungius' painting of a silvertip grizzly is reproduced below, chosen from a number of works by this celebrated artist. The effect of this type of portrayal, which is executed with obvious power and precision and presents accurately the customary vegetation and background in which the animal lives, is to give the beholder an intimate impression of the personality of one of the earth's great creatures

Courtesy of the N. Y. Zoological Society
From a Kodochrome by Charles H. Coles



but lower of limb and very well armored defensively."

The outline and proportions of Dürer's illustration are correct and portray a specifically recognizable Indian rhinoceros; but the fact that Dürer had never seen the animal is betrayed by his misunderstanding of the nature of the skin, which he draws as if it were jointed armor plate, with overlapping scales on the legs.

At about this time, the end of the fifteenth and beginning of the sixteenth centuries, the new spirit of observation is best exemplified by Leonardo da Vinci. As in so many other fields, his genius in animal art was far ahead of the time, and he made elaborate and often beautiful studies of the proportions, musculature and other details of common animals, especially horses. In this he had able though lesser followers, and the horses of Renaissance art are often splendid animal portraits, suggestive of the Greek tradition that inspired them. The animals, however, are usually subsidiary parts of a more extensive and more human whole. They are elaborated details of some decorative painting or monumental sculpture—not scientific illustrations.

Some of Rembrandt's sketches of captive exotic animals, such as camels and elephants, in the seventeenth century, show a great artist conscientiously recording the true appearance of an animal. Thereafter scientific animal drawing and painting, with one exception, neither made nor needed any significant advance in method or in skill, much as they have advanced in the range and variety of subjects covered.

The exception lay in the drawing of animals in rapid motion, the details of which often escaped the eye of the most careful artist. An example familiar to everyone is the representation of galloping horses with all four legs extended. Running animals in Stone Age drawings are sometimes shown this way, and this mistake, as ancient as art itself, is almost universal in animal art until our own days. The pose is artistically satisfactory: it conveys the sense of motion that the artist felt. But it is scientifically incorrect: animals do not really assume this attitude at any one instant while in the act of running.

It was photography that solved this last problem and raised animal portraiture to the peak of perfection now attained. Eadweard Muybridge's experiments, instrumental in the invention of motion pictures, were especially directed toward finding out exactly how animals do move, and they showed that almost all drawings of animals in rapid motion had been incorrect. In the hands of many expert photographers and explorers like Carl Akeley and Martin Johnson, the camera has now recorded an enormous variety of animals, both still and in motion, in their native surroundings. The recent extensive use of color photography has made scientific records that are well-nigh perfect and that compare with the bestiary miniatures, for purposes of scientific illustration, about as a hydroplane compares with a dugout canoe, for travel over water.

There seems to be no memory of the name of the genius who first decided that the best possible record of the appearance of an animal would be the animal itself, or at least its skin, filled out so as to imitate life. This is a relatively recent development, and really serious efforts at taxidermy for scientific purposes were probably not made before the eighteenth century. That even this method is subject to falsification is shown by what must be one of the oldest extant mounted animals, a hare formerly in the "Curiosity Cabinet" of the Duke of Württemberg, Germany, and at last accounts still preserved in the Natural History Museum of Stuttgart. Its peculiarity is that it has a pair of well-developed horns, which were, of course, ingeniously inserted with intent to deceive. This legend of the horned hare goes back to the bestiaries and earlier and is still alive. A few years ago in Montana I saw a very similar mounted horned jack rabbit, a hoax by some local taxidermist who surely had never heard of the Duke of Württemberg and did not know the respectable antiquity of his joke.

The museum exhibits of animals in the nineteenth century were literally stuffed, a word that makes a modern taxidermist cringe. The technique was to take a skin, stuff it full of straw or the like, sew it up, attach black shoe-buttons for eyes, and stick it in a case with others of its sort. The result was usually a travesty of the original animal, far exceeded in scientific value by contemporaneous paintings of animals. Some efforts were made to show animals more realistically and in action, but they were rare. The masterpiece of the old school of taxidermy was one of the original exhibits of the American Museum and was thus described in the *Evening Post* (when William Cullen Bryant was Editor) at the time the Museum was first opened to the public in 1871:

"The object most certain to strike the eye of a visitor is a group of animals mounted by M. Verreaux for the Paris Exposition, where it was awarded a gold medal as the finest specimen of the taxidermist's art. It represents an Arab mounted on a camel attacked by a lion and lioness. The lioness has been shot and lies dead upon the ground, while the lion, reared upon its hind legs, grapples both the camel and the rider, who is in the act of aiming a blow at the monster with his knife. The camel, with head bent back, is apparently uttering a cry as the claws of its assailant sink into its flesh. The Human figure is of wax, while the animals, of course, are the real beasts, admirably mounted." (That the human figure should be wax was not inevitable at that time. Human skins were sometimes stuffed for exhibition. A few years ago in the great Natural History Museum of Paris I saw the mounted skin of a Hottentot belle, formerly on exhibition but withdrawn behind the scenes when she began to crack.)

Taxidermy has since advanced almost unrecognizably. The skins are no longer stuffed but are mounted over a cast and sculptured base faithfully representing every detail of the play of muscles. The surroundings of the animals are also reproduced with complete accuracy and the groups arranged in internally lighted cases with painted backgrounds. A scientifically exact, three-dimensional piece of the animal's home is transplanted into the museum, and the animal is placed in it as if frozen in a living pose. Here, as far as we know, is the end of the long story and the culmination of the slow evolution that began many thousands of years ago in the caves of Stone Age France.

THE MYSTERY OF THE FIG

The natives said they hung wild figs in the orchards to keep away the evil spirits

Wasps are now being raised by the million to fertilize the domestic figs

By PAUL BULLA *with illustrations by* LAURENCE BLAIR

The Smyrna fig is a lady, and that is why the natives could raise luscious fruit and the Californians only shriveled buds. But a scientific Odyssey spanning two continents was necessary to solve this amazing riddle, in which a tiny insect became one of the most pampered passengers ever to cross the Atlantic

SINCE long before the Pilgrim Fathers stepped off the boat, our forefathers have been sold on the idea that the shortest distance between two points is a straight line. That is axiomatic; or is it? Mother Nature might give you an argument.

"If I plant an Irish potato," you say, "I will have spuds sooner or later. And that little seedling out back will most surely bear apples some day, or I'll be amazed."

You are probably right. But did you ever try raising Smyrna figs? If by any chance you attempted that feat you must have reached the conclusion that you had been going nowhere and had arrived. And you were right again. No edible Smyrna figs grew on your tree because you were all out of everything that makes them flourish and develop into the delightful fruit you know. All you had was the fig tree, and Mother Nature was detouring just for the fun of it.

It so happens that Smyrna figs are the finest in the world, but they are not native to America. This fact, however, meant less than nothing to us after we had acquired an appetite for them. They grew in Turkey, so why not here? Why pay a tariff to Turkey when our Southern California climate was made to order for this fruit? That seemed to be good, straight reasoning.

Back in 1882 Julian P. Rixford, Business Manager of the San Francisco *Bulletin*, aided by the United States Consul at Smyrna, imported 14,000 cuttings of true Smyrna fig trees into California. These *Bulletin* cuttings were widely distributed as goodwill offerings among the subscribers to that newspaper. With much publicity and fanfare they were planted. Then the importers and recipients sat back and awaited results—and it turned out to be quite a wait.

The cuttings flourished and four years passed, but there were no figs. In the third and fourth years tiny, shriveled buds did appear, but these withered and dropped from the trees before maturing. There was dismay in the orchards. Here were fruit trees that bore no fruit, trees whose leaves apparently failed utterly to intercept the rays of the California sun. The conundrum did not tend to increase the advertising value of the *Bulletin* venture.

An appeal was made to the United States Department of Agriculture for aid, and a scientist was sent to the Near East to discover why Smyrna figs worked for the Turk but "soldiered" in America.

When our investigator arrived, he was able to piece out the curious story which was already known in some of its details and to pave the way for a successful industry in California. He found not only many orchards of trees bearing Smyrna figs, with their rich, sugary pulp and nutty flavor, but also a wild fig tree whose fruit was known as "caprifig." This fruit, small and hard, was never eaten. When these caprifigs were mature, the natives would gather them and, looping them on strings, hang them in the orchards that produced Smyrna figs. This was done, they explained, to keep evil spirits from destroying the fig crops. The mental processes of our scientist were not short-circuited by this tale. He had learned soon after his arrival that the natives were violently opposed to competition in the growing of Smyrna figs by any other country, and so he was not surprised at this ruse.

One day he observed a number of small wasp-like insects emerging from the ends of the suspended caprifigs. They crawled about on the wild figs for a while, then flew to the Smyrna figs and, alighting at the free end of these figs, burrowed into them. So furiously did they bore their way into the figs that the wings of many were torn from their bodies. After a short time they reappeared and fell to the ground, where they quickly died.

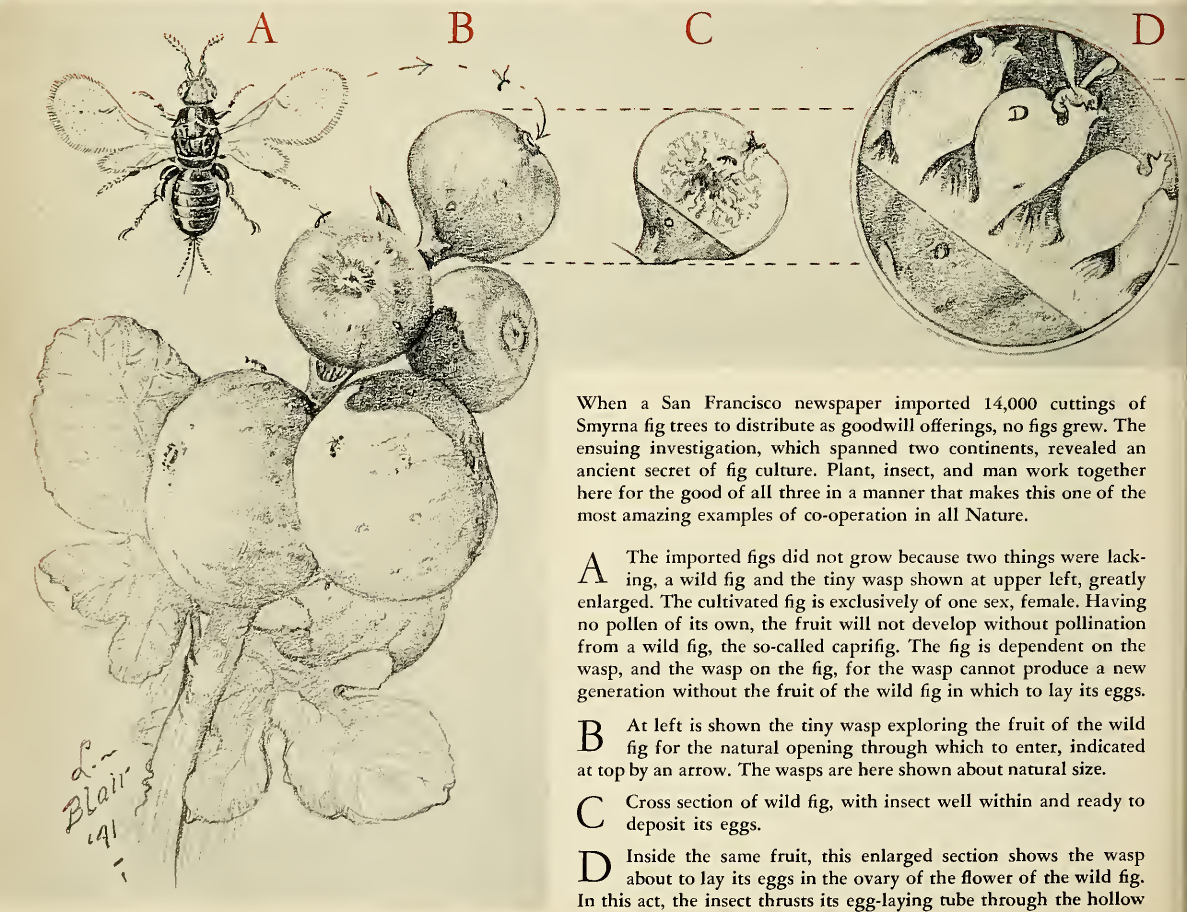
On opening one of the figs the scientist verified the fact that it was not a true fruit at all but a pear-shaped bowl containing dozens and dozens of flowers. Inside this bowl were tiny pistils but no stamens, which proved that the Smyrna fig was exclusively female and produced no pollen.

Further investigation revealed that the caprifig with its stamens was the male variety, and while it was inedible it yielded an abundance of pollen. If these tiny flowers within the floral cavity of the Smyrna fig were not fertilized by the pollen from the caprifig, seeds would not form, and the fruit we know would not develop. Our scientist was no longer confused. The strange metamorphosis of a flower into a luscious fruit was explained, for it could be no other than the little insect magician, burrowing so frantically into the Smyrna fig, who had performed the function of pollination.

The female of this tiny wasp perforates one of the ovaries inside the caprifig and there deposits her eggs, for only in wild figs are these insects able to breed and survive. The presence of eggs in the ovary causes a gall to form about them, and it is in these galls that they develop. The male wasp is hatched out first. He has no wings and so never leaves the wild fig in which he is produced. When he is able to crawl about the floral cavity he punctures the gall in which the female is developing, and mates with her.

After the mating the female emerges from the gall and crawls about among the stamens, where she becomes covered with the pollen of the wild fig. Finally she finds her way out through a hole in the end of the fig and flies away, seeking another wild fig in which to lay her eggs.

In seeking such a place, the female wasp enters both Smyrna figs and caprifigs. As young wasps cannot live in Smyrna figs, it is mad instinct alone that drives the female to enter, mistaking this fig in her search for the wild variety. Many of these insects



When a San Francisco newspaper imported 14,000 cuttings of Smyrna fig trees to distribute as goodwill offerings, no figs grew. The ensuing investigation, which spanned two continents, revealed an ancient secret of fig culture. Plant, insect, and man work together here for the good of all three in a manner that makes this one of the most amazing examples of co-operation in all Nature.

A The imported figs did not grow because two things were lacking, a wild fig and the tiny wasp shown at upper left, greatly enlarged. The cultivated fig is exclusively of one sex, female. Having no pollen of its own, the fruit will not develop without pollination from a wild fig, the so-called caprifig. The fig is dependent on the wasp, and the wasp on the fig, for the wasp cannot produce a new generation without the fruit of the wild fig in which to lay its eggs.

B At left is shown the tiny wasp exploring the fruit of the wild fig for the natural opening through which to enter, indicated at top by an arrow. The wasps are here shown about natural size.

C Cross section of wild fig, with insect well within and ready to deposit its eggs.

D Inside the same fruit, this enlarged section shows the wasp about to lay its eggs in the ovary of the flower of the wild fig. In this act, the insect thrusts its egg-laying tube through the hollow reach the goal they seek—a caprifig—, where a new life cycle takes place. However, many others find their way into the Smyrna figs and thus give their lives to the benefit of mankind.

For within the Smyrna fig cavity the female wasp moves about, seeking a place to lay her eggs. She finds no short-styled ovaries in which these eggs may develop. But all the while pollen, which she brought from the caprifig, is falling from her body and fertilizing the tiny pistils within the fig. By this magic and the error of a tiny insect we are able to enjoy the honey-sweet fruit of the Smyrna fig.

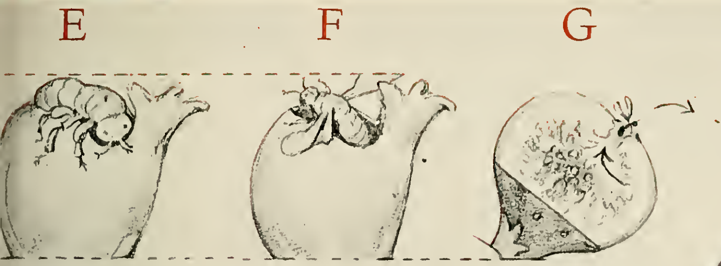
After our scientist reported his findings to the Department of Agriculture, several attempts were made to bring the wild caprifig trees, with their cargo of insects, to this country, but all were unsuccessful. The difficulty that confronted the Department was in getting these insects to the United States before they emerged to seek a place to lay their eggs. For within the caprifigs the little wasps passed through their life cycle in two weeks. Without new and fresh caprifigs the insects could not survive; and there was no means of getting them to California within that time.

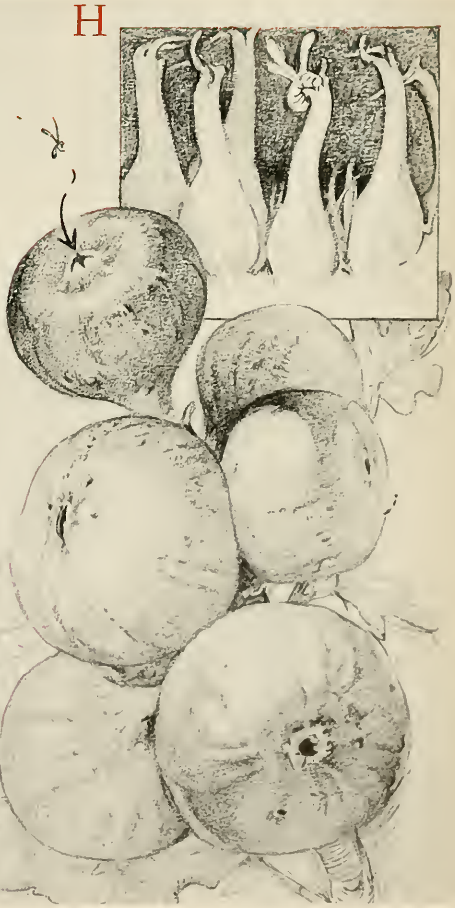
After four years the problem was solved. Wasp-infested caprifigs were collected in northern Africa, the nearest point to the United States where they were available. Wrapped in tinfoil to preserve the moisture, they were rushed to California. They arrived none too soon, for almost at once they emerged from the caprifigs and commenced to lay their eggs in the growing wild figs provided for them.

In four weeks thousands of fig wasps were hatched, and from then on they increased rapidly. Wherever Smyrna fig trees grew in California, caprifig trees, with their wasp-laden fruit, were grown nearby, and everywhere abundant crops of the rich, nutty fig were produced.

Today Smyrna figs, grown in California (where they are known as Calimyrna figs), are as luscious as those produced in their native land, but should some blight kill off all caprifigs, Smyrna figs would disappear from the earth.

The health of these small insects is of major importance to the fig orchardists on the Coast, not only because they are indispensable to the industry but because of the discovery that they may spread a brown-rot disease to the Smyrna figs from infected caprifigs. To prevent this the little wasps are being reared by the millions in sterile incubators and released in the orchards free from brown-rot germs.





center of the neck-like style to the ovary. This operation is impossible in the edible fig, as the style is too long, as shown at H.

E When the eggs hatch and develop in the wild fig ovary, a male wasp must be present to fertilize the newly matured, imprisoned female. Here the male, a wingless insect, is shown gnawing a hole in the ovary.

F Now fertilized, the female escapes through the same opening and is on her way out in search of other figs in which to lay her eggs.

G In leaving, she becomes dusted with the pollen of the wild fig, which is grouped about the opening as indicated by the arrow. In this act, the wasp becomes the key to the Smyrna fig industry, for the Smyrna fig has no pollen of its own and will not bear edible fruit unless pollinated by this insect carrying it from the wild fig.

H The wasp, in search of caprifigs in which to lay her eggs, "blunders" into Smyrna figs. They do not serve her purpose, for she cannot lay eggs in their ovaries (because of their greatly elongated styles), but she serves man well. For in this act she pollinates the fruit, enabling it to develop into the valued product of commerce. Growers in the Near East were observed to hang strings of wild figs in their Smyrna fig orchards. Investigation of this curious custom revealed the intricate chain of events described here.

The Massacre of St. Valentine's Day

Strange things are bound to happen when an ancient Roman Fertility Rite is inducted into European society

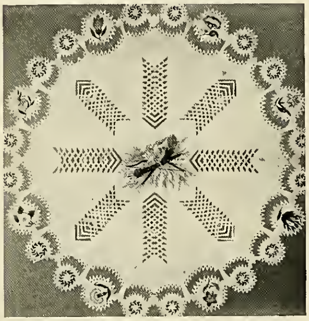
By D. R. BARTON

WHENEVER a popular custom is torn loose from its moorings, it seems to roll along a tortuous course through time and space like a rudderless ship, gathering barnacles and all manner of incidental accretions until the original shape and line is very nearly obliterated. Such, at any rate, appears to have been the fate of the old and mellow festival known as St. Valentine's Day. Two Roman churchmen who had precious little to do with cupid's bow, or with each other, have given the day its name. But their biographies offer so unreasonable a basis for the general character of the celebration that scholars have digressed into a variety of byways seeking explanations a bit more on the amatory side. Etymologists have suggested that v and g are often interchangeable in popular speech; that "valentine" may be derived from the French *galantin* (gallant) and that the name of the two saints came to be applied more or less through the repetition of an error in proof reading. It is also barely possible that the old English "voluntyne" might be a Latin derivative meaning "willing love" or something of the sort. However, neither explanation is particularly satisfactory.

As for the saints themselves, the first Valentine was a martyr, but not to love. He was executed during the Christian persecutions promulgated by the Roman Emperor Claudius. The other Valentine died most unromantically when he choked on a fishbone. It is generally agreed that the feast day named in their memory stems from the pagan rites comprising the Lupercalia, a collection of ceremonies for the most part calculated to conjure fertility and easy delivery among women, which, in ancient Rome, were celebrated each February in honor of the deities, Pan and Juno Februata. All this, of course, went on for a good many centuries before either of the saints was born.

For some reason or other, one feature of the Lupercalian ceremonies called for the jumbling of young ladies' names in a pot. These in turn were drawn by all the young men, the idea being to find out who was going to be your best girl for the coming year. Whether this was a means of divination or simply a lottery is not clear. But it does seem that the young gallants of old Rome penned nothing in the nature of:

"I want my dear maid a sweet partner for life,
So tell me in earnest that you'll be my wife."



From N. Y. Historical Society

Nineteenth-century lovers sent delicate, hand-cut valentines

The custom was a literal embodiment of "the marriage lottery." But matrimony apparently was never mentioned.

However, the pastors of the early Christian church soon began working overtime to eradicate pagan superstition and particularly the pagan moral code. They knew—or presently discovered—that these ancient and deeply rooted modes of behavior could not be utterly abolished. Therefore, as with nearly all of the pre-Christian feast days absorbed in the Church, they sought to apply an over-layer of *post facto* respectability. Transforming the earthy gaiety of the Roman festival into an otherworldly lesson in piety, they substituted saints' names for those of buxom lassies. Each saint became a patron for the coming year, serving as model for the daily behavior of whoever pulled his name out of the pot. This Procrustean distortion of custom must have strained many a young man's patience—imagine drawing the scabrous St. Simeon Stylites in lieu of the local Juliet—and it was not long before something like the original practice bloomed again.

Yet, when it began to reappear, the Church had at least won a point. For superstition now emphasized that every girl who was drawn stood an excellent chance of marrying the boy before the year's end. And the girls had also won a point. Their place was no longer exclusively in the pot and they, too, were privileged to draw names. The lottery became coeducational and therefore highly complicated. Everyone had *two* valentines: the one you drew and the one by whom you were drawn. Custom dictated that you owed most of your allegiance to the former. But the complexities of the situation in a monogamous society can readily be seen.

Fertility rites and Semitic monotheism simply don't mix, and though Valentine's Day survived as a kind of bootleg Lupercalia, the Church had so adulterated the mixture as to deprive it of most of its original vigor. The ritual gradually lost dignity and degenerated, seemingly in response to the inherent confusions and contradictions. Medieval France yields a significantly garbled example. Here the practices corresponded to our mock marriage and were inextricably bound up with the ancient Lenten fires. This is what happened. The names of various young people were called out in pairs as they assembled around the bonfire. Obviously the barker or master of ceremonies, out for a laugh then as now, would strive to hit upon the most grotesque combinations possible so that all serious values were jettisoned. The ritual required an exchange of gifts between the couples, and in this exchange we discern the long arm of Mother Church. The presents were called *rachat* (ransom or redemption) and were supposed to redeem the whimsically paired valentines from the flames of the (eternal) bonfire. Any pair which failed to give presents was burned symbolically in small fires kindled at their doorsteps.

From this it would appear that the custom of exchanging presents on Valentine's Day was originally a matter of souls rather than hearts. Of course, we don't exchange today—it's only the man who pays—but this restriction is a heritage dating from the England of the Stuart Restoration, when an elaborate spirit of courtly gallantry sprang up in the wake of Puritan reformism.

Chance or choice

Valentine's Day has undergone so many local modifications that it is very difficult to discover anything resembling a straight line of development, even when we confine our attention exclusively to England, where counties and shires differed markedly in their methods of celebration. One thing seems fairly clear, however. If the festival were to have any real significance as an institutionalized means of seeking a mate, Choice would sooner or later have to supersede Chance. On the other hand, if the day were set aside for the purpose of taking auguries, then Chance would naturally remain in the saddle. And, for a time at least, it did.

The persistent—and probably clerically inspired—superstition that your valentine would eventually become your wedded husband gave rise to a variety of ways of ascertaining his identity beforehand. For example, a young woman would enter the churchyard on St. Valentine's eve, wait until the clock struck twelve, and then run twelve laps around the church, declaiming:

I sow hemp seeds, hemp seeds I sow,
He that loves me best come after me and mow.

According to tradition she scattered real hemp seed, expecting to see the image of her future spouse puffing after her through the gloomy night air. Equally bucolic and perhaps even more liable to misunderstanding was the unmaidenly custom of peeping through keyholes before opening doors on Valentine's Day. If the damsel spied a cock and hen in company, it was a good omen that she would marry before the year was out.

Dreams have always been interpreted as prophecies, and the divining of a future lover's identity by inducing nocturnal fantasies scarcely comes as a surprise. Devonshire girls once picked yarrow from a man's grave repeating: ing:

Yarrow, sweet yarrow, the first I have found,
And in the name of Jesus I pick it from the ground.

The yarrow was then placed under their pillows before retiring. Or they might cross their shoes in the form of the letter T, saying:

I place my shoes like the letter T
In hopes my true love I shall see
In his apparel and his array,
As he is now and every day.

We have a record of one eighteenth century young lady who took extraordinary precautions to ensure dreaming. She pinned four bay leaves at the corners of her pillow and placed a fifth in the middle. Then, hard-boiling an egg, she removed the yoke, filled the cavity with salt and ate it shell and all without speaking or drinking afterwards. Unfortunately we do not know precisely what images this gastronomic feat caused to appear in her sleeping mind. One would surmise, however, that she took sanctuary in the nearest nunnery.

The means of divination on Valentine's Day were legion. One of the simplest and apparently the most prevalent is handed down to us in a verse of the poet John Gay:

"Thee first I spied, and the first swain we see
In spite of Fortune shall our true love be."

Accordingly, Pepys, in his immortal *Diary*, records that he laughed heartily, one Valentine's Day, because his wife had to sit all morning with her eyes shut for fear of spying one of the house painters who had come in to redecorate the apartment. Evidently valentines had by this time lost their significance as courtship overtures. They were valid for one day only, and it made no difference whether you were married or not. Both Pepys and his wife had valentines, the latter being claimed by a little shaver named Will Mercer, who is judged to have been about twelve years old, and who presented her with the first illustrated valentine ever mentioned in English literature. It was about this time that the custom of giving presents began to decline. Some of the gifts were very expensive, and apparently the game hardly seemed worth the candle. Gallants reneged at squandering jewelry worth several hundred pounds on some lady whose attachment was fleeting and purely ceremonial.

The festival had become avowedly artificial. Even writers of the time were alert to the decadence, and Lord North wrote: "A lady of wit and quality . . . would never put herself to the chance of a valentine saying that shee would never couple herself but by

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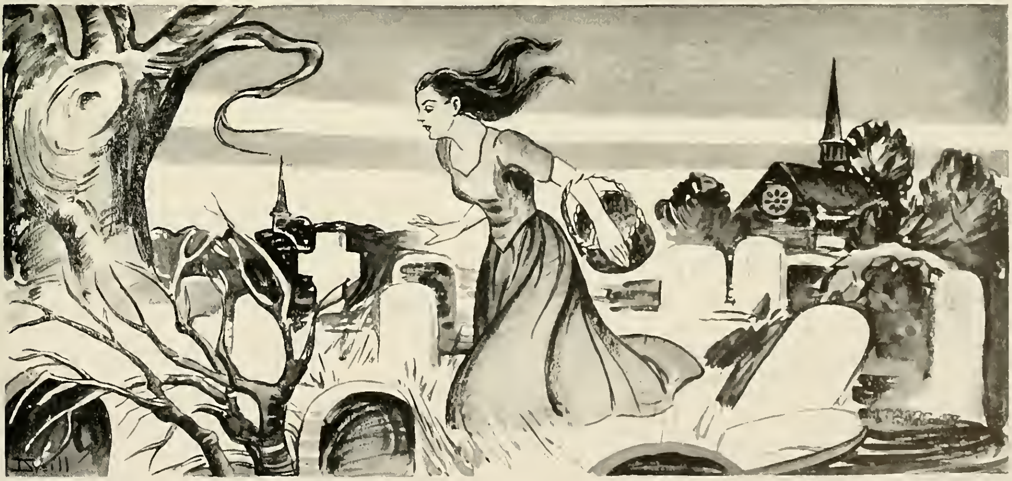
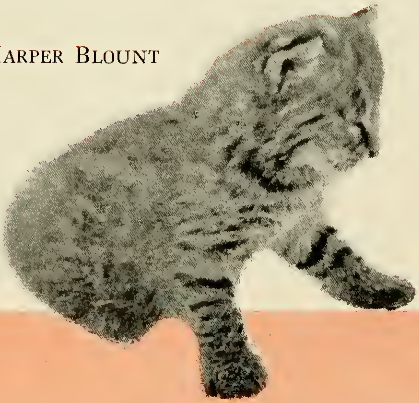


A LYNX IN THE HOME

By ISABEL HARPER BLOUNT

WITH PHOTOS BY THE AUTHOR



GERONIMO at six weeks *(above)* and at four years *(below)*. Originally hailing from Arizona, he was named in honor of the Apache chief. When found, he weighed only 1¼ pounds and could not walk

A RUBBER SYRINGE proved an ideal milk bottle, until Geronimo began to use the syringe as a squirt gun. Early tantrums were stopped by grabbing him by the scruff of the neck and the "seat of the pants"

The story of Geronimo, a bay lynx, who enjoys life in city apartments, hotels and Pullman trains: 29 pounds of wildcat made tame and affectionate

It was over four years ago that we adopted him—a bay lynx. Two kittens about two weeks old had been taken that day from a cave in the vicinity of Carlsbad Caverns and were offered for sale at a local store. We chose the smaller, which weighed one and a quarter pounds, because of the beautiful symmetry of his markings. And so we found ourselves suddenly the proud but rather solemn foster parents of a very strong personality. His eyes, though open, evidently could not yet focus accurately, and his hindquarters collapsed when he tried to walk. But his large head, broad chest and low-pitched growl gave an impression of vigor and determination.

The low, gurgling growls and faint but unmistakable efforts to spit continued throughout the first night. Every two or three hours we attempted to feed him diluted evaporated milk, either with a spoon or by a soaked cloth wick; but he struggled and consequently got very little. It was not till two days later, when we were able to obtain a tiny wide-mouthed doll's nursing bottle with a suitable nipple, that he began to get enough to eat.

After three days away from his mother he had received almost nothing, but he seemed to have grown in strength, and the feeding process every few hours was quite a feat of patience on everybody's part. The kitten was wrapped firmly in a towel to secure his hind feet, and held on his back. Since the nipple had to be kept on with the fingers, the sharp little teeth went under our nails, and strong paws with claws exposed pushed against our hands. But the kitten grunted and worked hard with evident pleasure, and we felt that the first step in his upbringing was accomplished. We soon began giving him small pieces of meat, which he licked and sometimes swallowed.

We traveled five days by car, and each day he gained in size. The growls and spitting had ceased after the first night. On the fourth night we were surprised to hear a loud and insistent voice calling to us from the next room in a tourist cabin. Upon entering we found he had climbed out of his box and was staggering across the floor in our direction. After this he always came to meet us when we entered the room, giving a trill of greeting, "Brrrrt." He also often trilled when he was covered with a towel.

We had named him Geronimo in honor of the famous Apache in whose territory he was born.

For a bus trip from Phoenix to Minneapolis a young lynx needed a comfortable basket with a lid, and a good-sized nursing bottle. Ultimately we found such a basket with a small padlock to secure it; and in a drugstore my husband's eye discovered a three-ounce rubber ear syringe, which proved to be ideal, since it was self-filling and required no separate nipple.

At the start of the bus journey we decided to make Geronimo as inconspicuous as possible. The moment he woke and cried we popped the syringe into his mouth, and he eagerly drained it. From then until he slept again we tried to keep him from climbing to our shoulders where he could be seen in the driver's mirror. While one of us played with him the other spread out a big map above him in which we pretended to be enormously interested. The passengers quickly caught the idea and refrained from exclamations. It so happened that two ladies were cat fanciers and very sympathetic. Fortunately at first there was a baby on board which sounded just like Geronimo.

We dared not lunch with the other passengers. We always dashed off to some other restaurant where we could buy milk, rinse and fill the syringe, and eat something ourselves if there was time.

We had some trouble getting Geronimo to sleep in time to take the bus at five in the morning. During the thirteen-hour ride to Denver we were observed by the steward to be carrying an animal, and it was his painful duty to report this to the driver. At Trinidad the latter explained that animals were no longer permitted on buses. We argued that since Geronimo had been allowed to start he should finish his journey, and accordingly he proceeded, but only in the baggage compartment. The steward surreptitiously brought him out at all lunch stops, and the kitten would then give a loud squeal of mingled indignation and pleasure.

In a Denver café the sizzling of a steak caused the first signs of fear we had seen in Geronimo, although he must have been about three and a half weeks old by this time. During our six-hour wait in this city the kitten was well treated in the barber shops and hotel lobbies. A great deal of the time was spent on the steps of a church where we thought up suitable answers to the remarks of the Veterans of Foreign Wars, who were swarming in the streets. In their condition a milk bottle seemed more out of place than a wildcat.

In Omaha it was a relief to see Carlsbad, our box-turtle, and Geronimo wander at will in a large hotel room with an electric fan overhead, and this rest was a good preparation for the final day of the trip.

At Sioux City we almost missed the bus while we played with him and tried to tire him into sleeping, but he seemed full of energy. Just as we were despairing and the bus was starting, he suddenly gave in and we stepped aboard. That evening a fresh, cheerful little lynx who was rapidly outgrowing his basket, and two people worn out by the six-day effort at smuggling finally reached home. As we left, the driver of our last bus asked to see what was in the basket. "Oh, I thought so," he said.

A big kitten with big emotions

It was necessary to begin some sort of training, for we did not want Geronimo to become so badly spoiled that he would be an impossible house pet. We wanted him to realize that he was a member of the family. An animal in the home comes to feel keenly his own importance and responsibility, especially if he is endowed with as much intelligence, energy, and alertness as the lynx possesses. From the first, Geronimo took himself seriously and felt so strongly on all subjects, that it was lucky he proved to be bright and teachable.

First the kitten was housebroken to the use of a pan, and this took only two lessons. In fact he got the idea only too well and kicked the sand with all four feet all over the room until the pan was empty. We found that pebbles were better than sand for such a vigorous kitten.

Geronimo soon grew big and strong enough to climb onto chairs, sofa, and bed. Once in the middle of the night, long after he had retired to his basket as usual, we heard a piteous outcry. He had managed to scramble to the top of an old-fashioned canvas trunk and was frightened because he was unable to get down. This showed what he could do, so it seemed necessary to train him in regard to the furniture. To exercise and to see from the windows he was allowed on certain pieces, but forbidden on others. At first he was taken from the latter and set on the floor, this action being accompanied by the word, "Down." Later when he clearly understood where he was not supposed to go and obeyed the command "Down," we began punishing him for infringement of these rules by slapping him on the thigh with the flat of the hand or a rolled newspaper.

Geronimo's den

Since he was exceedingly active, a place was needed where we could leave him when not being watched and yet where he would have plenty of room to move about. In the apartment only one such space was available—underneath the bed. So an enclosure with big gates was made of this whole area. The structure was suspended from the springs of the bed an inch or so above the floor to make it easy to clean under the edges. The strong wire mesh all round enabled him to see everything that went on about him. In this "house" were kept his dish of water or milk, his pan of pebbles, and a coconut to play with. As Geronimo grew, this pen had to be made higher and higher, until finally the bed was raised on tall posts with its surface 39 inches from the floor.

From the beginning Geronimo enjoyed being sponged off with warm water. We soon began to shampoo him all over once every few weeks. In spite of a good deal of discomfort he puts up with the lathering and spends a number of hours after the bath drying and arranging his fur. If the bath is given when he is getting a new coat it hastens the shedding. We always give him a light meal before his bath so that there may be something in his stomach for the hair to collect upon and prevent the formation of hair balls.

Geronimo only gradually learned the self-control he now exercises. Not only was he pretty free at first in the use of teeth and claws, but he was quite formidable if he seized and defended some object we didn't want him to have. The first of these occasions arose when he began to chew up a sock and garter. When we tried to take them away, he went into a real tantrum. Finally he swallowed a good deal of both. The next tantrum occurred at about three and a half months of age and concerned the ear syringe from which he still took his milk. He was often annoyed when the milk didn't come fast enough to suit him, and also he had discovered the charm of chewing the tip, ruining several syringes in this way. Finally, while being fed in the middle of the night, he grabbed the syringe, which was full of milk, and jumped out of reach. When we tried to approach he shrieked and gave the syringe a squeeze, which squirted milk all over us. His failure to get milk in the mouth only infuriated him further; he yelled louder, squeezing harder and sending milk over window curtains, rugs, and furniture. Sitting up on his haunches he boxed with exposed claws, his little tail lashing and his eyes blazing. Only when we tossed some old syringes into the arena was he persuaded to drop the one still shooting milk. This was his last bottle feeding. The next time there was a tantrum my husband held Geronimo firmly against the floor by the scruff of his neck and the "seat of his pants" until he tired of screaming. After this there were no more genuine tantrums. Although he still likes to defend a towel or a new toy against our advances, it is really only a game.

Excitement for its own sake

Through his first year cod-liver oil was added to his food daily. He was usually given his meals in the kitchen at that time, and would refuse to eat, running back and forth between me and the food until I took up the position he wanted between him and the rest of the house, presumably to protect his rear against imaginary rivals for the meat. If my husband appeared, Geronimo responded with terrible growls and tail-switchings. However, when I went out of town my husband was accepted as a perfect substitute at meals. This, I think, serves to illustrate Geronimo's love of excitement for its own sake and the way he plays with his imagination.

During February and March Geronimo's second teeth came in, the process being completed when he was about seven months old. The four canines erupted before the first set were out, so that he had eight at once. As he was trying to get rid of the loose ones, we finally took them out for him with our fingers, and each time he was quite triumphant and congratulatory. During teething he began the practice of taking one's hand between his teeth and lying very still with his eyes closed. If one could stand the pressure he would finally go to sleep this way, but the pain was almost unbearable.

At about a year and a half Geronimo commenced something that the Persian cat fanciers had warned us about. Like a dog he began to leave signs about, marking especially his own house and the front door of the apartment. He was so proud of this new habit that it took patience and repeated punishment to break him of it.

Geronimo has never been mated, but shows a somewhat greater restlessness and excitability during the late winter and again during the late spring.

He has had but one illness. Before the age of a year and a half his jaws had become strong enough to make an impression on his hard rubber toys. He began to vomit frequently, and an X-ray picture showed a mass in his stomach. An operation was performed in a university laboratory; the stomach was opened, and hard rubber, sponge rubber, and part of a tennis ball were removed. The next week he allowed us to take out the stitches and in two weeks he seemed about as usual. The result of this has been to make us exceedingly careful about the toys.

What is now the daily life of our house-lynx at four years of age? Like a child he enjoys repetition and tries to keep us to a regular routine. When the alarm clock goes off in the morning, for instance, he is troubled if we do not get up promptly. My husband usually takes him with him to his bath, and Geronimo is so afraid of being forgotten that he utters several very clear, sweet notes when he thinks the time has come for this ceremony, and allows himself to be drawn from his house, sometimes by one foot, and carried off over the shoulder. As an afterthought he usually remembers that he may be sponged or dipped, and he alternately purrs and growls.

From the bathroom he watches for the milk trucks that supply the apartments in great numbers, hiding behind the curtains when they appear. He follows their progress along the street to a distance of several blocks, craning his neck and exhibiting real excitement. He understands that one of these brings his own milk, but pretends to think they are dangerous. After superintending the bath and shaving, he is glad enough to return to his house, groom himself with wet paws, and doze.

At noon Geronimo has a drink of skimmed milk and plays for several hours about the apartment. If he is in a quiet mood he may sit looking out of a window, or follow what goes on outside by moving from one window to another. Or he may lie on the elevated bed whence he can see along two streets. He misses nothing of what takes place even several blocks away, children and motorcycles exciting him most perhaps.

Ball games

If Geronimo is frolicsome it is best to give up what you are doing and let him have a good workout, otherwise he is likely to try to attract attention by going to forbidden perches, or merely threatening to do so, while carefully watching you for the effect. He is allowed to select the toy or ball he wants us to use, as several are kept in his carrying case to which he has access. If he sits down and gazes at a certain drawer where the tennis ball is kept when not in use, or chews our wrists or "tags" us, it means he wants to play one of several games of his own invention. He crouches around a corner somewhere with his hind feet well up on the wall behind him to give a better push-off, and as the ball comes past he pounces on it. Sometimes you wonder what has become of him, and then you realize that he has been patiently waiting for some time out of sight with his feet up behind him. There are several black spots on the wallpaper where he has done this habitually. In another game he waits for the ball under a chair or just around a corner with one eye and ear showing. Then instead of pouncing he shoots out one arm and rolls the ball smartly back. Often he will send it back half a dozen times so accurately that it is unnecessary to change one's position.

"Batting practice" consists of throwing the ball high to him as he sits on the bed. With a fine, free action at the shoulder Geronimo knocks it across the room with a resounding whack, using either the right or left paw. When he is really on his high horse he races back and forth without any ball, leaping from the bed, going round the davenport, and returning with as much noise as a dog would make.

One day we covered him with newspapers, saying, "Where's Geronimo? Where's the kitty?" He caught on to this game at once, lying very still for a few moments and then popping out, saying , "Wunh." He often indicates his desire to play this. Geronimo enjoys a tug of war and knows just how to throw his weight into it. Balloons delight and alarm him. He goes through all the motions of defying them, stalking with back up, whiskers forward and pupils dilated until he gets up courage to puncture them. He then receives our congratulations with evident pride.

Then there are the times when Geronimo just feels how good it is to be alive, when he "dribbles" a ball or a lemon all over the apartment by himself, or when he takes his coconut in his arms, rolls over on his back and passes the coconut from one side to the other over the top of his head. Or he may simply say, "Wunh," turn on his back, and beg you to get down and tickle him. When we write at the desk he repeatedly lands on the paper with a simple easy motion and stands there for some time, effectually preventing further progress.

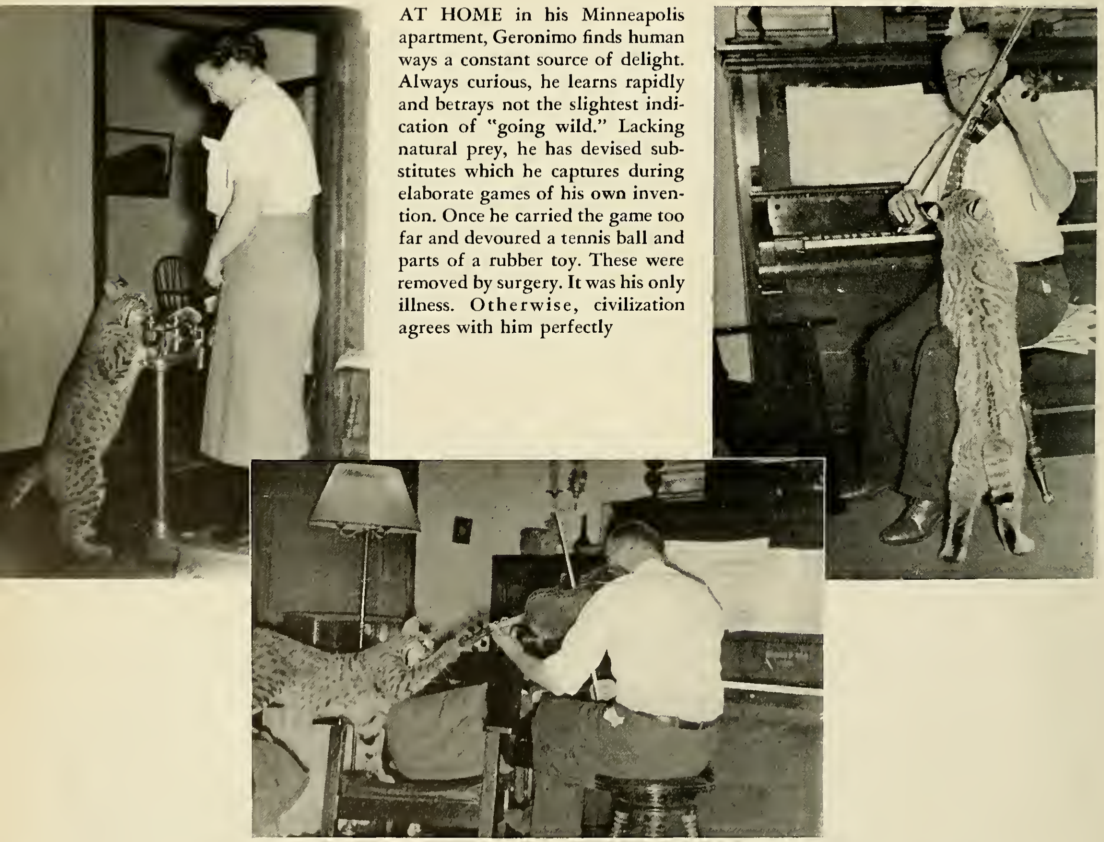
"Draw my bath, please"

In hot weather he likes to have a little water in the tub and be allowed to play by himself in the bathroom. It looks afterwards as if a small child had been there. During a recent heat wave one of us had drawn a deep, cold bath—but Geronimo got there first! He was standing up to his shoulders in the water, hissing with nervousness, his eyes big and black. Fixing them on our faces and breathing hard, with whiskers forward and growls of discomfort, he gingerly lowered himself "to his elbows" but not clear down.

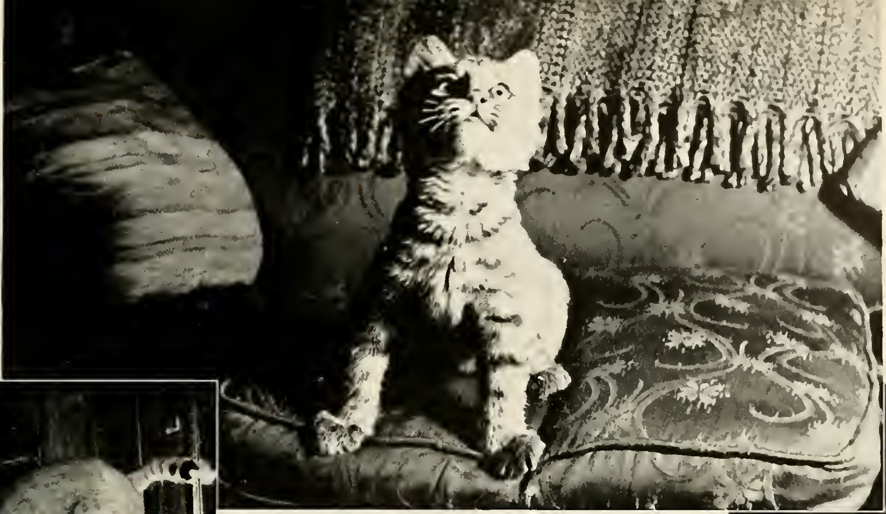
After his own dinner Geronimo likes to superintend the preparation of ours. He has been allowed to taste anything he has a mind to try, with curious results, as he has bitten into an onion and a grapefruit with consequent disillusionment. This experience taught him to carry grapefruit and lemons without biting into them. Celery intoxicates him just as catnip does; he rolls on it and becomes strongly perfumed with it. He is really enthusiastic about ripe olives. No bouquet of flowers is safe for a minute, his favorite perhaps being chrysanthemums.

A welcoming leap

Geronimo is always listening for my husband's return from work so that he can rush out, jump to his shoulder and caress his head. During the early evening he is usually in a quiet, companionable mood. He may crouch or lie on the bed, stretch out in the living room on a bare part of the floor or on a window ledge, panting like a dog if warm, or in winter

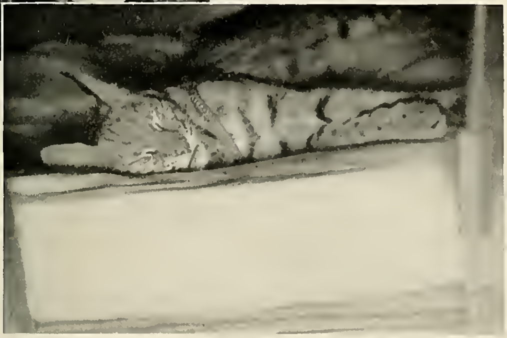


AT HOME in his Minneapolis apartment, Geronimo finds human ways a constant source of delight. Always curious, he learns rapidly and betrays not the slightest indication of "going wild." Lacking natural prey, he has devised substitutes which he captures during elaborate games of his own invention. Once he carried the game too far and devoured a tennis ball and parts of a rubber toy. These were removed by surgery. It was his only illness. Otherwise, civilization agrees with him perfectly

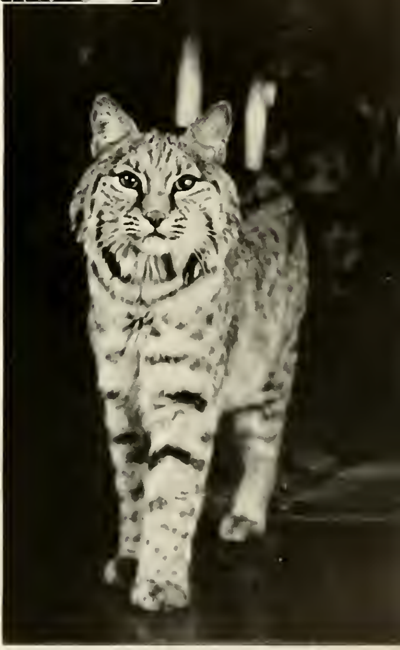


PARLOR MANNERS: Geronimo has the run of the house except for certain pieces of furniture. At three and a half months *(above)* he has apparently treed some luckless "quarry"

EXPERIENCED TRAVELER: *(left and below)* Geronimo is quite at home in Pullman coaches. He thoroughly enjoys snoozing in upper berths and finds as much fun in the metal washbasin as in any wilderness pool



(Right) GERONIMO disproves the superstition that wild animals will not look humans in the eye. He follows conversations by watching each speaker intently



THOUGH his diet is largely raw beef, Geronimo tries everything. Celery affects him like catnip, and he loves flowers, especially chrysanthemums. His loyalty to his owners is comparable to a dog's. If you have the patience to train a lynx and romp with him, your reward will be the affection of an intelligent, perennial child

on the back of the davenport, with closed eyes. Every few minutes he comes up to us, going round our shoulders and presenting muzzle and then tail in greeting.

Just before bedtime my husband often romps with Geronimo. This is the time when he likes to turn on his back and invite a wrestling match. If we go on all fours he is sure to "leap frog" over us (another game of his own invention). He may stalk about with arched back, ruff out and whiskers forward, getting ready to attack. He tolerates being held by all four feet and swung in circles to be landed on his side on the davenport.

He may assert his independence by remaining in the living room after we have declared it bedtime. His eyes can be seen reflecting the light where he patiently waits for us to come after him, so that he can jump out and surprise us. If we don't come, sociability finally overtakes him and he creeps gradually nearer and nearer, till he gives in and enters his den. But perhaps what he likes best of an evening is to have us read aloud beside him while he lies in his house. This is true family life in his eyes.

Unless he is exceptionally drowsy, Geronimo will answer when spoken to after the lights are out with a cheerful warble. During most of the year he then keeps quiet until the alarm clock goes off again in the morning. Sometimes in the spring, when it gets light early and the birds begin to sing, he is bored and cries. We then throw a little water on him which keeps him busy washing himself till he falls asleep again.

Lynx etiquette

It is customary for Geronimo to press his forehead against familiar playthings and people, particularly an outstretched hand. If we introduce him to new friends, he presents first his muzzle and then his tail. He also declines an object courteously with his forehead. After he has eaten his dinner he usually "gives thanks" in a loud, triumphant whinny. This seems wholly an expression of satisfaction.

Geronimo "warbles" by rapidly opening and shutting his mouth and nodding his head up and down. He once did it thirteen times in one outburst. It can be as shrill as a whinny, soft and sweet, or round and full. All these inflections are employed in talking to us, varying with the situation, and he evidently believes himself to be understood in some detail. Indeed this is so, for his needs are fairly limited, and one can guess what he wants. A prompt response on our part to his legitimate desires has led to deeper understanding and greater use of language on his.

Geronimo purrs only under conditions of complete comfort, mental and physical, as when we are all tucked in bed after a hard day, or when he is lying drowsy in his den and we stroke him while he licks us. About the only other time he does it is when we have just returned to him after an absence of several hours.

Geronimo growls when nervous, when pretending to be fierce as in some of his games, and when objecting to rough handling, when it may sound quite perfunctory and simply means, "No, please don't. You might hurt me." During the games or in extreme nervousness, the ruff stands out, the whiskers come forward, the back is arched. The gait becomes stilted, and the growls alternate with blowing through the nose and hissing, with the tongue showing between the front teeth. The hair along the middle of the back may rise. The growl may be as loud and deep as that of a large dog, but rises to a shrill whine. It should also be noted that the nose drips under emotional stress.

Crying (the nearest thing to a "meow") simply means boredom, the wish to be let out of the den, or general dissatisfaction. It is the only unpleasant sound he makes, and should usually be ignored. It often culminates in real deep-throated cuss words and a snort of exasperation.

On the few occasions when he has been visited by friends during our absence, Geronimo has talked to them in a cordial manner.

No doubt the action of the tail should be included in a description of language. Though only about six inches long, it is strong and seldom quiet, waving gently from side to side when he is gay, and switching rapidly during his rougher games. When he is watching events from a window unobserved, only the tip moves, but that very fast and nervously. When he watches our box turtles through the crack under a door it is like a house cat watching a mousehole, and the tail switches audibly.

Geronimo's affection for us is comparable to that of a dog. He does not mind showing his feelings, and it might be noted that he is obviously worried when one submerges all but one's face in the bathtub. Knowing what baths are, the cat seems afraid that one might go too far with them. He is also disturbed if one of us pretends to spank the other, who then cries. He stalks about in great excitement and a state of indecision about his own duty. When we pretend to make up he rushes forward warbling and tries to be included in the embrace. I have little doubt that he would help us out if we were attacked by strangers.

Geronimo the traveler

Geronimo has proved to be a pretty good traveler and has taken several long train journeys, partly in baggage cars and partly in a Pullman compartment with us. We carry him in a traveling case designed for a terrier. Although he likes to sit on the seats and look directly out of the windows, he may perch instead on one of the tiny shelves and watch the landscape go by in a mirror. At night he spends a good deal of time ascending and descending from one berth to the other. In fact, I do not believe I was dreaming the time I saw him jump with a sort of corkscrew movement from the upper to the lower direct.

We have been surprised and gratified at the matter-of-fact way in which a lynx is welcomed at hotels both large and small. Ours has been offered a place in the kennels of one large hotel; and in some, registration cards are kept for pets. When released in our room he explores every inch of it. At the least alarm he goes under the bed, the nearest thing to his own den he can find.

It takes a good deal of exercise to satisfy so great an athlete. A year ago he weighed 29 pounds, is 31 inches long (six being tail), and stands about eighteen inches high. Like a cat he jumps to our shoulders and even to the tops of doors without effort, and the latter is his favorite place for trimming his claws. At an early age he could be observed calculating distances and planning new and daring jumps in the apartment. If he dreams it is probably of such feats. In his flying leaps from the dining room to the bed or vice versa (nine feet), he likes to dive through the small openings in the footboard. He walks on the rim of the bathtub and can fish objects from the water with his forepaws while keeping his hind feet on the edge of the tub. He "banks" with all four feet high against our bodies, sometimes when going at full speed from one place to another round a curve.

In Arizona when people speak of the "lynx" they evidently refer to the brightly marked subspecies to which Geronimo belongs; while "bobcat" means a desert subspecies of a general yellowish shade with subdued pattern. Thus the people from whom we bought Geronimo said, "You'll be able to raise it because it's a lynx, not a bobcat." There was disagreement about which is larger, probably because more than two subspecies are involved.

At one of the California lion farms we saw a nest of baby wildcats which were snarling and spitting whenever anyone looked at them. The keepers remarked that here was one animal they found impossible to tame. It may well be that two or three would be much harder to train than one brought up alone in close association with human beings. Certainly we have known of more than one case like our own. There are few who would believe it possible, however, and the first question asked used to be, "When will he go wild?" Since he has become full-grown this question has changed to, "You keep his claws trimmed of course," which we don't.

Another idea is that the sight or smell of blood is what "brings out that wild instinct." "You don't ever give him raw meat, do you?" When we say that raw beef is his principal diet, people look as if they have suspected it all along and now they know we are lying.

The belief that you can't punish a member of the cat family is also firmly fixed in everybody's mind. We found this to be untrue. Not only does Geronimo take in good part a spanking with a newspaper or the flat of the hand, but he often gives away the fact that he has been up to mischief by protesting his innocence in melting tones and then lying down on his side in the spanking position.

One frequently hears the statement that a wild animal cannot meet the eye of a human being. Our cat looks into our eyes to corroborate what we are telling him, and also follows conversations closely by watching the face of one speaker after another.

Altogether the presence of a well-trained lynx in the home adds a great deal to the spice and pleasure of life. If you have the time and patience, if you always remember to be firm but just, if you have a simple household where there are not too many people to be disturbed, if you are willing to spend some time every day kicking balls or crawling on your knees looking for them under the furniture, and especially if you are able to do these things year after year, then perhaps you are the person to educate a house-lynx. It sounds like a recipe for bringing up a child, doesn't it? Well, that is what your reward will be: the trust and affection of an intelligent, perennial child.

THE MASSACRE OF ST. VALENTINE'S DAY

Continued from page 101

choyce. The custome and charge of valentines is not ill left, with many other such costly and idel customes which by a tacit generall consent wee lay down as obsolete."

Of course the "tacit generall consent" was slow in materializing and the "custome" did not die out by any means. It was carried on, along with many other similar practices that had long since wandered from their original function. But Choice came to the fore, and it was the smart thing to send frilly missives of affection on Valentine's Day to the maiden of your heart. In some quarters the elimination of the Chance element gave the valentine the force of an actual proposal and, no doubt, many troths were plighted on this historic day.

At first the verses were genuine, if crude: "Oh my love, my dear love pretty! How I love you!" garnished with a dripping red heart spitted on an arrow. But before long, valentine verses were being turned out professionally with the "heart-dart" rhyme scheme rivaling the "June-moon" of our own Tin Pan Alley. In 1797 there appeared a book called the *Young Man's Valentine Writer* and a few years later, *Cabinet of Love: or Cupid's Repository of Choice Valentines.* Included were verses suitable for different tradesmen. For literary quality, compare a quotation from one of these:

A piece of charming kid you are
  As e'er mine eyes did see.
No calfskin smooth that e'er I saw
  Can be compared with thee.

You are my all, do not refuse
  To let us tack together;
But let us join, my Valentine,
  Like sole and upper leather.

with the latest valentine message supplied by Western Union:

Dan Cupid's dart has scored a hit,
My wounded heart is off a bit,
But I'll gladly bear the pain
If my love's not been in vain,
Be mine, forever, be mine, my Valentine!

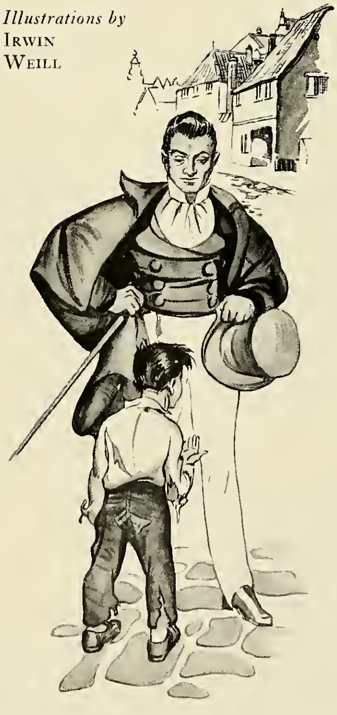
People frequently lament this industrialization of sentiment and regard it as a repellent by-product of compulsory literacy. But though our tastes might "improve" with time, we shall probably retain the commercialized sentiment until that doubtful millennium when everyone sketches and versifies with equal skill.

Perhaps even more cogent than the growth of democratic literacy was the rise of cheap postage. Early in the nineteenth century, reductions in mailing costs kept pace with new developments of the entire field of communication, and soon postmen were weighted down under a deluge of flowery verses and paper frills. But the boom was not for long, since the valentine subsided when the Christmas card came into favor in the middle of the century.* The latter rapidly outstripped its sentimental forerunner and continues the overwhelming favorite to this day, doubtless because Christmas occupies a much higher rank in our scheme of loyalties and because the details of its celebration are universally understood.

The valentines, meanwhile, again shot off at a tangent. Someone invented "comic valentines," verbal brickbats anonymously delivered, whose manufacture became a minor industry. Six million were sold in one year in the United States. Here indeed was the crowning perversion. It caused the time-honored festival to be turned over to a pack of scuttling, doorbell-ringing urchins. There follows an example of the sort of thing they left thrust in the mail slot; evidently a lineal, but malevolent, descendant of the "trade valentine" of former years.

Plumber

Of all the scamps you are the worst,
  You ugly looking snipe!
You swindle us with defective work,
  Wretched traps and rotten pipe.
And you're not alone a swindler
  But a murderer as well.
For you poison many with sewer gas
  Your thievish gains to swell.



Illustrations by
Irwin
Weill

Begging

Oddly enough, children have played a considerable part in undermining this feast day, which once clearly belonged to the age of puberty. Through their agency, Valentine's Day picked up a peculiar, mercenary quality which it shares with Halloween, Thanksgiving, Christmas, and even Good Friday.

In line with the latter is the strange note that children once used to beg a special type of pastry known as Valentine's buns, which apparently resembled hot cross buns. Also it was an ancient custom at Beaumanor in Leicestershire that all children who put in an appearance on Valentine's Day should receive a penny, while a house in Essex raised the ante by offering sixpence to every child who showed up at 8:00 a.m. The prevalence of this feast day begging can be seen in a number of verses which ring curiously to the modern ear:

Good morrow, Valentine.
Change your luck and I'll change mine.
We are raggety, you are fine
So prar gon us a valentine.

and

Knock the kittle agin the pan,
Gie us a penny if 'e can.
We be ragged and you be fine,
Plaze gie us a valentine.
Up wi' the kittle and down wi' the spout,
Gie us a penny and we'll gie out.

---

*In William S. Walsh's *Curiosities of Popular Customs,* occurs the following interesting statement: "The Christmas card is the legitimate descendant of the 'school pieces' or 'Christmas pieces' which were popular from the beginning to the middle of the nineteenth century. These were sheets of writing-paper, sometimes surrounded with those hideous and elaborate pen-flourishes forming birds, scrolls, etc., to which writing-masters still have an unnatural and inexplicable attachment, and sometimes headed with copperplate engravings, plain or colored. They were used by school-boys at the approach of the holidays for carefully written letters exploiting the progress they had made in composition and chirography. . . . Charity boys were large purchasers of these pieces, and at Christmas time used to take them around their parish to show and at the same time solicit a trifle."

This is certainly a far cry from the amorous festival of Pan and Juno Februata, and the answer seems to be that St. Valentine's Day, once removed from its Lupercalian beginnings, became a footloose vagrant, fixed on the calendar but otherwise a heavy borrower from other appointed days in all seasons among the peoples of western Europe. The churchyard divinations smack of Halloween.* The begging may originally have been taken from some religious ceremony of alms-giving. And with the arrival of comic valentines, the day has taken on some aspects of April Fool.

Nevertheless, it has been kicked about for so long now that we would hate to see it go. Charles Lamb has written a moving apology for the best that is in the festival, and we could do no better than to close on his note of buoyant optimism:

"However we may observe the day of St. Valentine, its character has been stamped by the generations who entered into its celebration sincerely, joyously, spontaneously; and however indifferent we may be, we cannot escape that influence which is the inheritance of years gone by, when swains became gallants, and the humblest maiden was made happy with a devoted valentine for at least a day."

---

*See "Halloween: Ancient Festival of the Dead," by D. R. Barton, NATURAL HISTORY, October, 1938, p. 224.

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BIRDS OF THE GREY WIND ● GEOGRAPHY IN HISTORY

BIRDS OF THE GREY WIND

- by Edward Allworthy Armstrong

Oxford, $3.50

LOVE of birds has prompted many authors to express themselves in print. The results may be valuable contributions to ornithology but only rarely do they reach the plane of literature. Here, however, is an author who is fully equipped to describe both the birds and the country in which he has found them. The youthful memories of an Irishman, living now in England, betray a longing for the land of his birth and its birds, which his inspired pen permits him to share with his readers.

Birds of the Grey Wind, therefore, is both ornithology and literature. We may refer to it for knowledge of the birds, chiefly coastal, of County Antrim, or we may read it for a poet's appreciation of the land and its legends. In either case we will discover that both the birds and their country have found a faithful and gifted historian. Hear him describe Strangford Lough as a "luminous water-colour of heroic dimensions, a saga in light; land and water become subsidiary and incidental, handmaids to a greater glory." "Ireland's charm," he adds, "whether in winter or summer, on moorland or shore, consists in no small degree in the spaciousness of her skies, her lovely clouds, opalescent distances, and the soft, clear radiance of every remote view."

The illustrations, from photographs by the author and others, were selected to avoid subjects suggesting with "monotonous reiteration that birds spend all their time brooding or dangling food into their chicks' mouths." Hence we have a series of unusual, attractive and informing pictures. The dipper and the roosting tree-creeper, the young cuckoo evicting a hedge-sparrow's egg, the chough and its young deserve particular mention, and one rarely sees a more truly pictorial bird photograph than that of the sparrow hawk.

FRANK M. CHAPMAN.

CALIFORNIA AND THE WEST

- - by Charis and Edward Weston

Duell, Sloan and Pearce, $3.75

HERE is a gorgeous book illustrated by 96 superb photographs taken by Edward Weston, with a text as good as the pictures, written by his wife. The project, which consumed two years, was carried out with the aid of a Guggenheim fellowship. The photographs were not made with a miniature camera, but with an 8 x 10 camera on a tripod, using panchromatic cut-film with K_2, G, or A ray-filters.

As indicated by the title, the country covered is mainly California from south to north, with forays into Oregon, Washington, Nevada, Arizona and New Mexico. The subjects photographed include breathtaking landscapes, desert scenes, ocean views, mountains, abandoned homes, ghost towns, drift stumps, storm clouds, farms, orchards, and vineyards—in short, an excellent cross section of the rich and varied West.

It is no disparagement to say that the photographs are not quite what most of us would have expected. There are no pictures of the Grand Canyon of the Colorado or of the California Bigtree. The point of view of the photographer is indicated by a remark he made when prospecting for pictures in Red Rock Canyon with its eroded spires, buttresses and natural cloisters: "What can I do with it? It's all done. Photographing this stuff would be like copying a painting. Anyhow, it's too damned pretty."

Mrs. Weston not only acted as chauffeur, but she also kept a careful diary from which she has drawn an informal and most readable book to go with these striking photographs.

CLYDE FISHER.

GEOGRAPHY IN HUMAN DESTINY

- - - - - - - - by Roderick Peattie

George W. Stewart, $3.00

GEOGRAPHY, says Doctor Peattie, is the reciprocal relationship between physical environment and life. Before he is through his book, however, even this fairly broad definition is considerably expanded. But no one should complain of the wide cast of Doctor Peattie's net, for he catches in it a fascinating array of information.

The trends of history and the broad characteristics of human cultures are what especially attract Doctor Peattie. His effort to explain these phenomena on a geographic basis furnishes the thesis of this book. There was a time not long ago, when environmental determinism in human affairs held a pre-eminent place in speculative writing. That position was lost by claims too great to be satisfactorily supported. As a result, environmentalism suffered a serious decline as a determinant in human history. But the truths of environmentalism, although forgotten or obscured for a time, cannot be disowned. They serve Doctor Peattie well in this revival of the environmentalistic philosophy.

With a carefully selected battery of examples of the geographic influence on the course of human history, Doctor Peattie advances an effective argument for his contention. His erudition is nicely concealed by a restraint in the use of evidence and by a pleasant, unacademic style. I heartily recommend *Geography in Human Destiny.*

H. L. S.

THE MAMMALS OF CHINA AND MONGOLIA (Parts I & II)

- - - - - - - by Glover M. Allen
Edited by Walter Granger

Each Part, $10

Published by the American Museum of Natural History

IN many respects there is no section of the earth's surface as interesting geographically, geologically, and biologically, as Asia. It is a vast continental mass that was the birthplace of many lines of animals, as well as of some phases of human culture. It is cut by numerous large rivers, between which are some of the world's loftiest mountain ranges, many of which, with their particular floras and faunas, are completely segregated from each other by low country, in some places of subtropical nature. Hence the problems in the distribution and interrelationships of the mammals of China are of extreme intricacy. Difficulties incident to sketchy methods of travel over great distances amid political conditions frequently unstable have contributed to the fact that as a whole the fauna of China has been incompletely known and poorly understood.

As a result of Roy Chapman Andrews' plans, so comprehensively carried out by the Asiatic Expeditions of the American Museum of Natural History, there has been accumulated the world's finest collection of Chinese mammals which, by an arrangement with the Museum of Comparative Zoology of Harvard, has been studied and here reported on by Glover M. Allen. This appears in two large volumes of 1350 pages, listing the 514 kinds of mammals recognized as occurring in China. There are 20 plates of photographs and 75 text figures, mostly distributional sketch maps. They are extremely helpful but show few details and localities, so that the reader finds himself wishing that even a small-scale map of the whole of China had been included. Only one who has worked over scattered descriptions of mammals from a strange country can appreciate the keys, not only of races but of genera, and the characterizations of the higher groups that accompany the present report. Besides original citation, there is for each kind of mammal a careful description with measurements, and as much about occurrence and habits as is known. The first volume included a historical and general faunal consideration and an exhaustive bibliography. This concerned insectivores, bats, primates, carnivores, cetaceans, pangolins, and hares and their allies (in all, 258 kinds). This volume appeared in 1938. The Second Part, just off the press, treats of the rodents, ungulates, and the sea cow. It is probably this volume that will appeal most to the average reader. Of recent years there has been a great interest in the game animals of Asia, which has resulted in a number of hunting expeditions with trained collectors among their personnel, and these have accumulated notes and material that have enabled Allen to clear up many of the moot points concerning the game mammals of China. Thus did Brooke Dolan rediscover MacNeill's deer on the Tibetan border, unrecorded since its original discovery in 1909.

Not the least of the difficulties in a study of Asiatic mammals is the fact that many of the types are scattered and inaccessible, and the early, and some later, descriptions are vague. Hence it is fortunate that the present report was prepared by one of the world's soundest and most scholarly mammalogists. His invaluable discussions of relationships in the present volumes are the result of many years of study and he shows a masterly grasp of the literature. But whereas weeks of work at the British Museum were deemed necessary, the author failed to examine many of the type and other critical specimens of Chinese mammals in the National Museum at Washington, at times accepting or rejecting the validity of the races under question on evidence that was largely circumstantial.

Regardless of the condition in which China may finally emerge from her present tribulations, it seems certain that the dispersal of the Chinese fighting forces, with their firearms, will result in the destruction at a greatly augmented rate of all the large animal species. Henceforth the collecting of these forms will doubtless present greater difficulties, and the world is indebted to the Asiatic Expeditions of the American Museum for accomplishing its work before it was too late.

A. B. H.

PRINCIPLES OF ANIMAL BIOLOGY

- - - - - - - - -by Lancelot Hogben

Norton, $3.75

THIS book "was not intended to supplant but rather to supplement the work in the laboratory, for which many excellent guides or manuals are available." Although the beginning student will find herein a fresh and stimulating approach to general biology it is unfortunate that the author has omitted reference to many important recent advances in various fields—a lack which is emphasized by the fact that this, the second edition, postdates the first by ten years. The choice of references is a difficult task, and must, in many instances, rest upon personal preference. It seems unfortunate, however, that a discussion of parthenogenesis should be limited to mention of Loeb's work (1899) with the eggs of the sea urchin. A brief account of contemporary findings with mammalian material (Pincus *et al*) would give a broader and more accurate rendering of the general topic. If the synthesis of adrenalin is worth mention it is difficult to understand why there is no reference to the fractionation, identification, and synthesis of numerous products of the hypophysis, thyroid, ovary, and testis. A discussion of sex reversal which is limited to recounting the effects of ovariotomy in the hen and parasitization in the male crab seems regrettably incomplete in the light of the impressive evidence for sex reversal subsequent to gonad transplantation or hormone administration.

Supplemented with comprehensive lectures and extensive laboratory work this book would serve admirably as a beginning text in biology. It cannot be recommended for the reader who lacks a reasonably thorough knowledge of comparative anatomy and general physiology.

F. A. BEACH.

AMERICAN SONGBIRDS

- - - - - - - By Maitland A. Edey

Random House, $1.00

THE distinctive characteristic of this attractive-looking book is its low price. In what other publication can you buy for $1.00, 30 of Louis Fuertes' colored plates illustrating 105 species of our land birds? It is true that these plates originally appeared in Eaton's *Birds of New York* and that they have also been used by the University Society (1917) and Doubleday, Doran & Co. (1936). But they cannot have too wide a circulation and we hope will brighten the text of many subsequent volumes. While the prints show the demands that have been made upon the plates, they are nevertheless acceptable reproductions of the originals.

The text prepared to accompany the illustrations gives a brief description of the markings, manner of occurrence and habits of each species.

F. M. C.

TRAIL OF AN ARTIST-NATURALIST

- - - - by Ernest Thompson Seton

Scribner, $3.75

EXCEPTIONALLY talented, constructive, ambitious, with the courage of strong convictions and the power to express them, Ernest Seton has set his life on a stage where, with the unstinted force of a highly dramatic nature, he has played a leading rôle.

Only his contemporaries realize the extent of our indebtedness to him as naturalist, artist, scribe, preacher, and sympathetic biographer of wildlife. To itemize the bill would take more than all the space allowed for this review. But the amount of the total may be indicated by the statement that, in the reviewer's opinion, Seton has done more to arouse an interest in nature than any other writer of his time.

Evidence supporting this belief may be found in this record of his life. If its author seems a prejudiced witness (autobiographers are often lenient) the doubter should seek the testimony of those whose life span covers the periods, before as well as after, the publication in 1898, of *Wild Animals I Have Known*. This was followed by other books addressed to nature lovers, young and old. In all, over two and a half million copies of Seton's works have been issued. His audience has been immeasurably increased by thousands of lectures, woodcraft councils, and by his activities as one of the originators of the Boy Scout movement.

Seton's success produced many followers who, lacking his standards, often wrote with disregard of truth. But all alike were condemned as "nature fakers" by conservative naturalists whose protests were voiced by John Burroughs in *The Atlantic* for March, 1904. Urged to defend himself Seton said, "My only reply will be in my works." And in due time they took form in four quarto volumes on the lives of North American mammals. Accepted as authoritative by his colleagues and awarded the Elliot Medal by the National Academy of Sciences, they form alike his vindication and crowning contribution to knowledge.

Of recent years Seton, now fourscore, in his New Mexican home, has devoted himself to a study of the North American Indian, greatest of our native mammals.

FRANK M. CHAPMAN.

THE CHORTI INDIANS OF GUATEMALA

- - - - - - - by Charles Wisdom

University of Chicago Press, $4.50

THIS book gives a full account of a typical Indian community in Guatemala. The style is compact and factual, presenting a surprising amount of information in the 490 pages of text. Every important phase of community life is well covered. What the reader will perceive is an ethnic group of Indian people under the nominal control of the Guatemala national government, loosely integrated into the framework of the Catholic church, taking no important part in the political affairs of the nation, except when a few men are temporarily drafted into public service for a brief interval or when they are confined in prison. From careful observation the author concludes that 70% of the diet is maize. Yet many other kinds of vegetable food are produced or gathered, the variety being impressive. As may be anticipated, animal food is but a small part of the community diet. Occasionally a deer is killed. Pigs, turkeys and chickens are raised, the pigs chiefly for sale in the towns, fowls for ritualistic purposes rather than for food. The meager monetary income of the family is chiefly from the sale of pigs.

The Indians are not grouped into social classes, but they themselves constitute the lowest social class in the nation; the mixed-blood Indian of the towns ranks next. Since Indians form a large part of the populations in Latin-American countries, this book, with its careful description of a typical Indian community, should give the reader a better comprehension of life in these countries.

CLARK WISSLER.

SCIENCE IN PROGRESS

Second Series

Edited by George A. Baitsell

Yale University Press, $4.00

THIS second volume of *Science In Progress* consists of ten National Sigma Xi Lectures delivered in 1939 and 1940. Each lecture was given by a leader in his field, and consequently we have in each chapter an up-to-date discussion of the subject. The material is presented clearly and interestingly and is profusely illustrated. The volume may be considered a modern encyclopedia of science in so far as these ten branches represent samples of the whole field.

Our leading geomorphologist, Professor Douglas Johnson of Columbia University, gives us the latest and best discussion of the mysterious craters of the Carolina coast, treating it as a study in methods of research. Dr. Carl D. Anderson, Nobel Prize Winner in Physics, of the California Institute of Technology contributes a comprehensive and yet popular chapter on cosmic rays and new elementary particles of matter.

The subjects of the other essays with their authors follow: "The Experimental Alteration of Heredity," by L. J. Stadler; "The Regulation of Plant Growth," by F. W. Went; "Experimental Studies on the Functions of the Frontal Lobes in Monkeys, Chimpanzees and Man," by J. F. Fulton; "How the Earth Shows Its Age," by Alfred C. Lane; "The Expanding Universe," by H. P. Robertson; "The Motions of Ions and Proteins in Electric Fields," by Duncan A. MacInnes; "The Ultracentrifuge," by J. B. Beams; and "Recent Advances in Aeronautics," by J. C. Hunsaker. An adequate bibliography for each chapter is given in the back of the book, together with an extensive index.

The Society of the Sigma Xi, which is devoted to the promotion of research in science, has made available here a most readable account of the methods and results of research in these representative fields.

CLYDE FISHER.

THE HISTORY OF MUSICAL INSTRUMENTS

by Curt Sachs

Norton, $5.00

IT is improbable that there exists in English any work on musical instruments so comprehensive as Professor Sach's 500-page volume. No branch of the subject is left unexplored and each is investigated with the caution of sound scholarship.

"Man alone is gifted with conscious rhythm." From this distinctive feature of human behavior have come both the dance and the invention of a staggering variety of music-makers. The history of their development proceeds through the devices of the lowest cultures up to the most complex instruments of the modern orchestra. Every considerable epoch in man's experience receives mention. A large number of halftones, line drawings and diagrams enhance the value of this prodigious reference book.

ANIMALS IN ACTION

by Gayle Pickwell

Whittlesey House, $4.00

THIS book is the fourth of a series of large natural history books, beautifully and profusely illustrated. The pictures are instructive and tell many stories far better than words can. The accompanying text is a splendid introduction to animal biology, succinctly describing the main problems of life. There are chapters on the shelters constructed and utilized, the ways of reproduction from amoeba to mammal, growth and development (including metamorphosis), ways of feeding and obtaining oxygen, defense, locomotion, evolution and the relationships between animals. Lastly there is a section telling how to become acquainted with animals, and some personal experiences of the author.

It would be pleasant to give the text unqualified approval, but there are several inexplicable misstatements: five-toed deer, digitigrade squirrels. These are minor, but definite, detractions from an otherwise splendid book.

JOHN E. HILL.

MODERN WILDERNESS

by William Arthur Babson

Doubleday, Doran, $3.00

WITHIN the network of broad highways crisscrossing the state of New Jersey there remain many areas still relatively wild. To one of these, scarcely 25 miles from lower Manhattan, Mr. Babson calls particular attention. Along the Passaic River near its junction with the Whippany lies a swampy wilderness where wood ducks and black ducks nest, and one may find the larger owls, hawks, mink, skunk, and occasional beaver and deer. In youth the author studied its many birds, and recently made it his hunting ground during four profitable years.

He gives us a collection of essays rather than a systematic account of all its wild inhabitants. These tell of his excursions by canoe or on foot to nests of the larger birds, of hatching wood duck eggs under a hen and rearing the ducklings on a lawn, of bringing up young crows as pets, catching huge snapping turtles, photographing a killdeer, and watching the "sky-dance" of the woodcock. Other adventures include one with a skunk, and there are talks with Jean, the trapper. Mr. Babson shares the belief of Doctor Chapman, who has written him an appreciative foreword, that turkey vultures are aided by smell in their search for food. He understands the sportsman's attitude, and discusses its paradoxical views on killing and protecting.

In the final chapter he laments the invasion of electric power lines, new bridges, polluted waters, and the deepening of the river for flood control. More automobiles race along the roads, more billboards rise, and the radio tells of war and bombing. But at the very end, Mr. Babson still finds beauty and serenity in his New Jersey wilderness.

JAMES P. CHAPIN.

PLANT GALLS AND GALL MAKERS

by Ephraim Porter Felt

Comstock, $4.00

THE abundance of drawings and photographs in this book is of great help in identifying the 2000 plant galls found in North America. For ease of determination, the galls occurring on a certain plant are grouped together and the types of galls are then separated by descriptive keys. The Introduction gives much general information on galls and gall insects and tells us of the extraordinary life histories of some of the latter. Naturalists, specialists, and teachers of biology and nature study will find that this reference book is both interesting and invaluable.

J. W. THOMSON, JR.

MANUAL OF CULTIVATED TREES AND SHRUBS

by Alfred Rehder

Macmillan, $10.50

IMMEDIATELY upon its first appearance in 1927 this manual became an essential volume in the horticulturist's library. This second edition, revised and enlarged, is even more essential to anyone working with woody plants. In concise form, with keys to families, genera, and species, it describes all of the trees and shrubs known to be in cultivation north of a line running approximately from North Carolina, through Texas and New Mexico, to northern California. Many native as well as exotic species are described. The zones within which the various woody plants are winter hardy are indicated by reference to a frontispiece map of the United States and Canada. Other useful facts included in the descriptions of the species are references to illustrations of the plants and their parts, mention of the habits of the plants in cultivation, of the place in which the plants are native, and the dates of introduction or first-known cultivation.

Over 2550 species are included in the second edition, about 200 more than in the earlier edition. The number of hybrids, varieties, and species but briefly described has grown proportionately. An indication of the scope of the work is the index, which covers over 14,300 names. It is remarkable, however, to find some of the smaller plants such as pipsissewa, spotted wintergreen, trailing arbutus, wintergreen, partridge berry, and snowberry included in a volume on trees and shrubs.

Changes in the International Rules of Botanical Nomenclature required some changes in the names of some of the plants and the new edition has been brought up to date in this respect. Fortunately, Professor Rehder has, with but few exceptions, adopted a conservative treatment of the genera and species of woody plants. On the eve of his retirement as Curator of the Herbarium at the Arnold Arboretum he has given us a most thorough and indispensable manual.

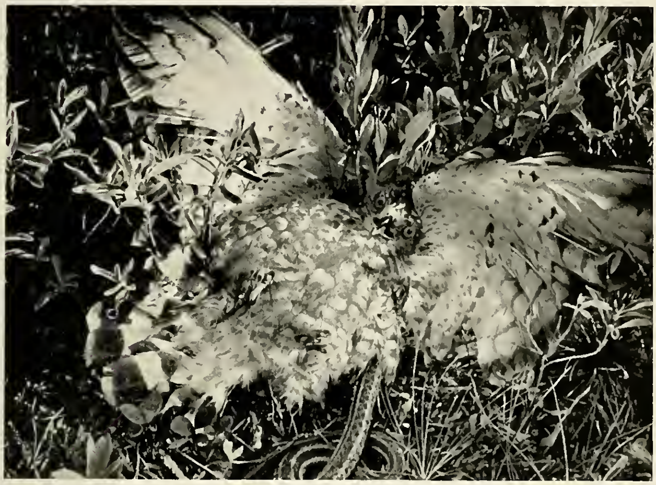
J. W. THOMSON, JR.

Continued from page 66

SIRS:

Late one afternoon in August, I was driving along one of the typical sandy roads in the heart of the pine barrens of southern New Jersey when I noticed a commotion in a thicket of sheep laurel *(Kalmia angustifolia)*. I ran to the spot and saw the unusual spectacle of a young broad-winged hawk which had tried to capture a snake and had as a result itself been captured. The 35-inch long garter snake had sunk its teeth into the under part of the wing of the hawk, preventing the bird from flying. The accompanying photograph was taken while the two struggled. (I felt a little sorry for the hawk—its pride must have been terribly hurt.) A moment later, I lifted the snake by the tail, and it released its hold, allowing the bird to fly wearily away through the tall pines.

Haddonfield, N. J. JOHN GILL.



Photograph by John Gill. From a Kodachrome original.

THE CAPTURER IS CAPTURED. This young hawk was "grounded" by the grip of the snake in its wing

SIRS:

I wish to express my appreciation of, and interest in, the article, "Talk-without-Talk," by Robert Hofsinde. The pictures are fascinating and are of great educational value. I hope we are going to have more articles and pictures by the same author.

GRETA BODELLE.

New York, N. Y.

* * *

SIRS:

I was very much interested in your article in the January issue on Indian sign language, "Talk-without-Talk," as I have been working for some time with the Flathead Indians on the sign language, too.

In comparing the signs Mr. Hofsinde used with my own records, I find a few differences as follows, probably the result of local differences in "dialect," just as we observe them in spoken language:

(1) Here the sign for "tree" is made by raising the hands upward to indicate growing toward the sky—without the "trembling like leaves."

(2) Woman: the two hands together at the center part of the hair are brought down on both sides, indicating that the hair is parted in the middle (as opposed to the way the men wear a lock tied at the top and a part on the side)—instead of the combing motion. Among the Flatheads and Blackfeet, only the squaws part their hair in the middle.

(3) White man: although the sign was in this case the same, my model, Louie Nine Pipes, and other Flatheads, explained that it was because the first white men had their hair cut across the forehead. They use another sign for "hat," indicating the brim with one hand on each side of the head.

(4) Buffalo: the forefingers indicate the curved horns of the buffalo.

(5) Hungry: Louie Nine Pipes points to his stomach with both hands, but does not use the "motion like sawing body in two with edge of the hand," as described by Mr. Hofsinde.

(6) Man: the Flatheads use the upright forefinger only for a young man, as it means a man who walks erect or a "youth." They never use it, as Mr. Hofsinde did, together with the sign for "old."

I have been working on a sign language dictionary, because I feel, as Mr. Harrington does, that it is too vital a part of Indian culture to be allowed to die, and because I, too, have found that even now only the older members of the tribe can speak it fluently.

JANE GREENOUGH.

Couer d'Alene, Idaho

* * *

SIRS:

As a reader of your excellent magazine, I wish to comment favorably on the sign language article in your January issue. It is splendid! I hope the author is considering a book on the entire subject.

New York, N. Y. CAROLINE BROWN.

Continued on next page

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SIRS:

Your January, 1941, issue has excited so much comment in my home, especially the article, "Talk-without-Talk," that in order to satisfy everyone I need another copy, for which I enclose 50¢. We think your magazine has set a new high among periodicals. Each issue is eagerly awaited and thoroughly enjoyed.

CHARLES E. CUSHING.
San Jose, Calif.

* * *

SIRS:

. . . At this time let me compliment you on your excellent publication NATURAL HISTORY, of which I have been a subscriber for a number of years.

HENRY B. CHASE, JR.
New Orleans, La.

* * *

SIRS:

I am so grateful for NATURAL HISTORY Magazine. Many people see my copy, including 20 Campfire Girls, who meet with me regularly. . . .

MRS. O. R. JOHNSON.
Columbia, Mo.

* * *

SIRS:

Your covers these days are the best, most impressive, and artistic in the world!

CHASE S. OSBORN.
Poulan, Ga.

* * *

SIRS:

We receive a score of magazines at our home, and NATURAL HISTORY is in the inner circle of a few magazines which are "must."

ALBERT EARLEY.
Georgetown, Del.

* * *

SIRS:

. . . Your magazine is increasingly popular in our home. . . . Many thanks for such an educational value in such an interesting and absorbing manner of presentation.

LEON W. ZIMMERMAN, M. D.
Liberal, Kansas

* * *

SIRS:

. . . Thank you for the pleasure which has come to our entire family through this excellent magazine.

MRS. WM. S. BARKER.
Arlington, Va.

* * *

SIRS:

. . . Every month NATURAL HISTORY brings so many interesting articles that the magazine is loaned to several families on the campus. It is a fine magazine for any library.

MAURINE LARSON.
Lapwai, Idaho

* * *

SIRS:

. . . We appreciate NATURAL HISTORY Magazine in my family very greatly, and particularly so because we believe it has a very beneficial influence on my twelve-year-old grandson, who is one of your subscribers. . . .

(SIGNED)
Milwaukee, Wis.

* * *

SIRS:

The Christmas present that gave me the biggest thrill of pleasure this season was the Certificate of Associate Membership in the American Museum of Natural History, along with a year's subscription to NATURAL HISTORY.

Through the kindness of a friend, I had access to copies of NATURAL HISTORY for the last three years, and in no other periodical I ever read have I found the contents from cover to cover so interesting and worthwhile. To welcome a copy of my very own each month through 1941 will be a joy. The December number with its beautiful Night Blooming Cereus cover and intriguing table of contents has already arrived.

Natural history has long been my major delight as a student. . . . Its revelations of perennial beauty, wonder, orderliness, if widely enough known, might become a precious antidote against despair, against cowardice, an inspiration to press on daringly, persistently, toward a better-yet-to-be, through this Dance Macabre transition from an old to a new era in world history.

May the American Museum of Natural History and its fine publications long continue their good work.

(MISS) M. E. MCGUIRE.
University of California
Berkeley, Calif.

* * *

SIRS:

In the November issue of your magazine, there appeared an editorial entitled "The Museum and World Changes" in which there were several statements which might easily be misunderstood and which, if not understood correctly, might be considered misleading, if not untrue. I have reference to the statements, ". . . when the principle of evolution became generally accepted," and ". . . because it [evolution] enjoys as nearly universal belief as any philosophy."

I am aware of the work that the Museum has done and the decided opinions it has in regard to evolution. However, I think it is not in accord with facts to say that evolution is generally accepted as a principle, or worse still, to represent it as something universally accepted. I can appreciate your point of view but I feel it is a little misleading to the uninformed reader to put the case as strongly as you have.

I have read and enjoyed this magazine for some time and have enthusiastically recommended it to a number of youngsters. I hope I shall not find it necessary to curtail my enthusiasm or qualify my endorsement in the future.

WILLARD T. KEANE, D.D.S.
New York, N. Y.

* * *

SIRS:

One of my most pleasant surprises in receiving my copy of NATURAL HISTORY Magazine each month comes from reading your Letters Department, and it gives me the greatest satisfaction to know that, with very few exceptions, each and every one who writes to you expresses my personal feelings in their high praise of the Magazine of the American Museum of Natural History.

I feel sure that all our NATURAL HISTORY readers, including myself, believe in the Creator's evolutionary laws, both as applied to the plant and animal life of the world and even to the earth changes which have taken place preparatory to the existence of organic life on this planet.

There has always been a conflict between religion and science on this issue of the origin of life, and particularly of man on this earth; but we are convinced by irrefutable scientific facts that God created all things in a slow and orderly series of evolutionary changes, which have resulted in our perfected forms of plant and animal life today. The American Museum's complete exhibit of the evolution of the horse from Eocene time to the present is produced from proven remains found in the rock pages of the earth's history. . . .

Words fail me to describe adequately the beauty and profound interest of the articles which the December, 1940, copy of NATURAL HISTORY contains. Each and every one of the subjects treated in this issue is right in line with my courses of study, and I am deeply grateful to you for your timely sources of information.

Could you furnish me with two extra copies of the double-page graph of the "World's Highest Waterfalls" covering pages 272 and 273? If so, kindly advise me as to the cost.

The article entitled, "The Tar Pit Tiger," by Edwin H. Colbert is most fascinating and comes close to my heart because I live only 140 miles from the famous La Brea Tar Pits in a suburb of Los Angeles and have visited them several times.

E. B. POWERS.
San Diego, Calif.

NATURAL HISTORY regrets that no extra copies of the waterfall chart referred to are available.—ED.

APPOINTMENTS

Dr. Robert Cushman Murphy, of the Scientific Staff of the American Museum of Natural History, has been elected President of the Long Island Biological Association.

Dr. George C. Vaillant, likewise of the Museum, has been elected Vice-President of the Section of Anthropology in the American Association for the Advancement of Sciences for 1941.

Dr. Harry L. Shapiro, Associate Curator of Physical Anthropology at the American Museum, was made Associate Editor of the *American Anthropologist;* and Miss Bella Weitzner, also of the Department of Anthropology, was appointed Treasurer of the American Anthropological Association at the same annual meeting in Philadelphia, on December 29, 1940.

NOTICE

Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

March **NATURAL HISTORY** 1941

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OLUME XLVII. No. 3

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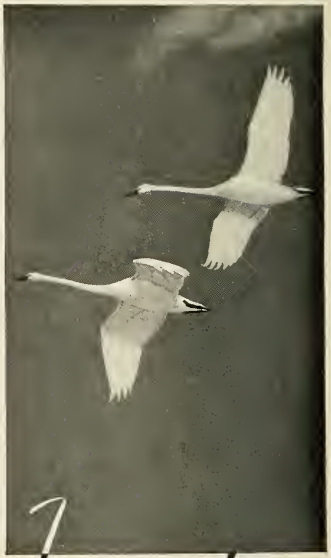

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Above illustration painted by F. L. Jaques, from Bird Group of Hudson Bay Region in the American Museum of Natural History

A LETTER FROM AN ENGLISH CORRESPONDENT

The secretary of an English naturalists' association tells how biological work behind the scenes helps the Army and the home front

YOU'VE probably read all the news about the war in your newspapers and listened to all the official communiques from Europe on your short-wave radio, and so I don't intend to deal with the war as such. I have just sat down at the end of a day's exacting work, and while we prepare to meet our 255th air raid I think I ought to tell you, an American audience, how I, an English biologist and secretary of a naturalists' association in the second most heavily bombed part of our country, have worked behind the scenes to help Britain's war effort outside the fighting line. Of course I won't say anything that might release useful information to an enemy agent, even if it passes the censor; but the wartime work of a naturalist is not generally associated with secrets and new campaigns.

When this war shadowed the horizon in 1939 I expected my time to be fully devoted to writing, lecturing, and instructing farmers and gardeners about growing more foodstuffs, because this island cannot support itself like France and America. But I've had very little of that sort of demand upon my time. We found that the farmers and amateur gardeners didn't want telling how to plant and grow vegetables in order to stock our larders: success was to be gauged by the number of ploughs and spades and men to work them, and land to plough. I thought I would spend a lot of time telling farmers how to get rid of their crop pests; but they say they are the same pests they had before, and they've been told often enough how to deal with them.

No, the job of a biologist or a naturalist in wartime is often as surprising and unexpected as the varied conditions affecting the fighting forces. I suppose my closest association with the war itself has been in consultation for Air Raids Precautions. You might wonder what on earth a biologist has to do with protecting people from blast, shrapnel, bombs, and splinters. Most people think A. R. P. is merely engaging builders to construct shelters for the people, medical men to care for the injured, and firemen to put out the fire-bombs. So did I in 1938.

In 1939 one of our national A. R. P. bodies was paying me to settle a number of biological problems as they arose. One of these concerned fungi. Many of our hastily-made shelters were safeguarded with sandbags or earth bags stacked against the walls. It wasn't long after the autumn rains that those bags of Hessian cloth began to rot, and suddenly a whole wall of sandbags might collapse, and anybody nearby might be injured. What was the cause of this rapid decay of sandbags in the rain, and how could it be prevented? It was all the work of a fungus or mold. Most of the bags were filled with earth, because people in many towns had better access to their gardens than to the seashore. And a wall of such bags developed a humid, poorly ventilated atmosphere, encouraging growth of the minute, dust-like spores of the fungus. Nearly all this damage was done by one mushroom—*Peziza repanda,* which normally grows on rotten tree trunks lying on the ground in our beech woods. Now it has become a common "resident" in nearly all our cities.

With the winter the shelters became the resort of hibernating insects, and in the community shelters in big towns there was a serious problem of fleas, lice, flies, and other insect carriers of disease. I was able to be useful here because most of our authorities had whitewashed the interiors of the big, public shelters and I had noticed that white is a color which attracts flies and gnats, whereas pale lemon-yellow is a warning color that actually repels them. Formalin sprays were able to keep check on the fleas where they occurred in some of the towns, and the bedbug was checked with fumigants.

Botany, too, has played its part in our A. R. P. work. Much of the cotton you send us from America is wanted for munitions and for surgical dressings for the Army. During the campaigns in the last war there was a shortage of cotton wool and similar surgical material in England, but as there were no great casualties from air raids at home it was not serious. This time, however, there must always be a good reserve of surgical dressing for first aid during air raids. Therefore, I got to work on another emergency substitute, which was used in the field in the last war and in the Spanish war. This is dried and sterilized sphagnum moss from our moors and hillsides. This moss has, in point of fact, considerable advantages over cotton wool as an absorbent in surgical dressings, for it has very large cells normally used to store moisture against drought. It proves not only more absorbent than cotton wool bandages but more retentive, thus requiring changing less often.

The food industry, which is so vital to an importing country like ours, has brought me a lot of work identifying and controlling the molds and insects attacking stored foods in ships, warehouses, and flour mills. A great number of the insects have to be fought with low temperature sterilization because the usual fumigants and sprays would contaminate the foodstuffs. But the difficulty is that different temperatures are needed to kill or check the activity not only of different insects but of the same insect in different stages of development, as egg, larva and adult. Many of these temperatures are still unknown. Molds are generally checked by temperature control, and although they receive less publicity, they are just as destructive to industry as insects. When great stores of foods are accumulated, new insect invaders are apt to appear, because insects often alter their diet and change from useful into very destructive agents.

Continued on page 119

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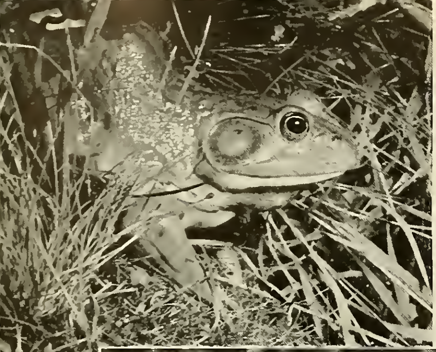
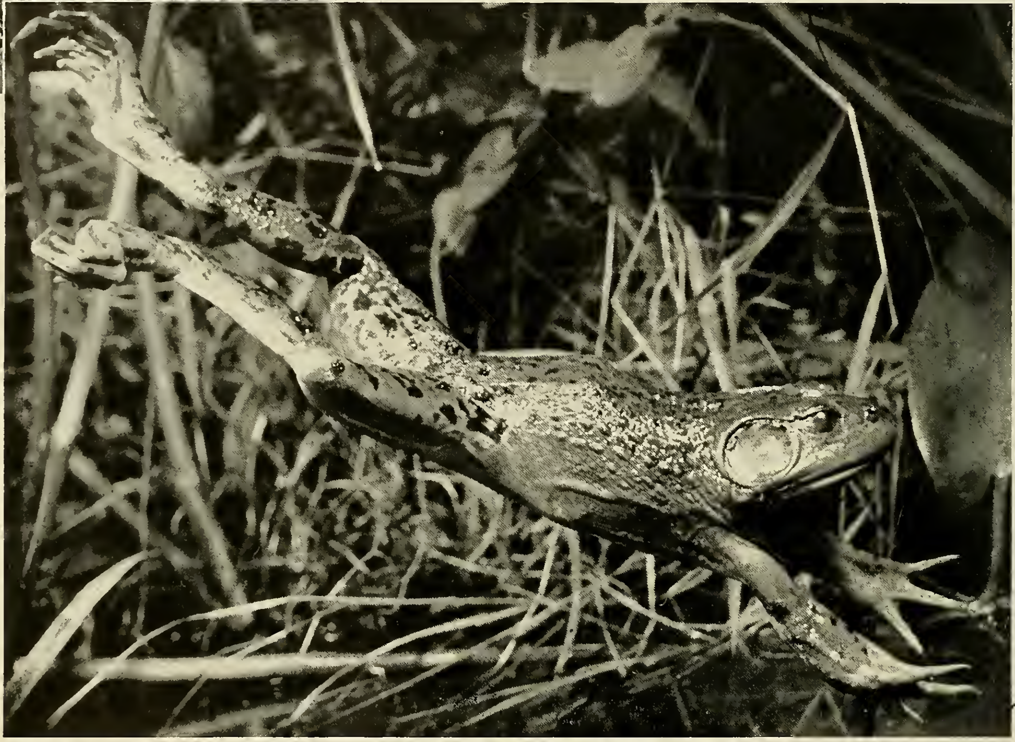
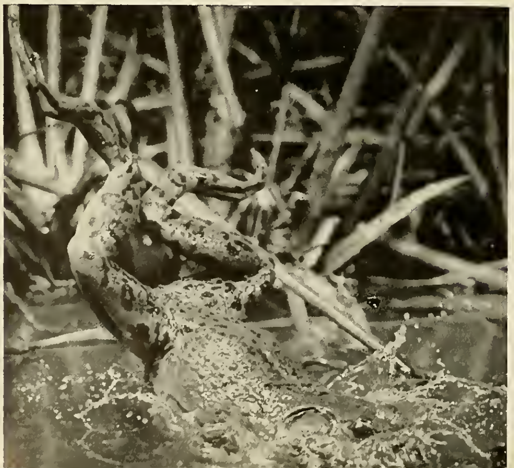


1 The bullfrog is always ready to leap . . .

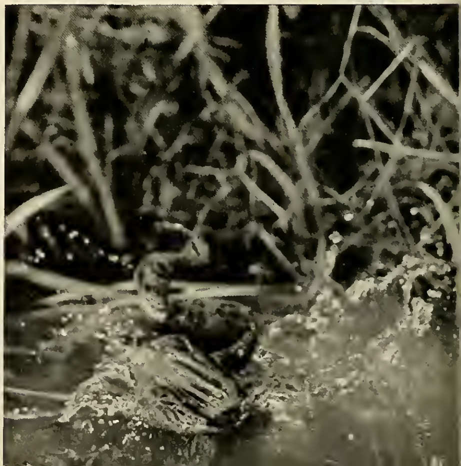


2 . . . through the air with the greatest of ease . . .

3 . . . into the water . . .



4 . . . and out of sight . . .



A LETTER FROM AN ENGLISH CORRESPONDENT

Continued from page 117

The naturalist was also called upon to recommend to the food manufacturers new sources of raw material for food when the war on the continent of Europe cut off many of our old food imports. These new sources varied from new methods of canning wild rabbit meats with onion and other palatable ingredients, to herbs, salads and fruits from the wild, and the recommendation of gull and other common birds' eggs suitable for cooking purposes when there was such a great egg shortage after our poultry flocks suffered havoc in the hard winter of early 1940.

The drug industry made a special appeal to the British Empire Naturalists' Association to marshal its forces of field botanists. This was to help overcome the shortage of drugs due to the sudden cessation of normal imports from the continent. High prices were offered for certain wild plants from which drugs can be manufactured, for instance, foxglove, which is a source of digitalis, henbane, which gives hyoscyamine, deadly nightshade, which gives atropine, and so on. Before this I had induced our botanists in the Merseyside Naturalists' Association, of which I am Secretary, to draw up a list of all the useful herbs growing in the district, whose seeds could yield products for the drug industry. There were over a hundred of them.

Investigating current conditions in glasshouses and conservatories at a special meeting, we found it was possible to cultivate under glass the plant sources of such drugs as cocaine, strychnine, camphor, ipecacuanha, etc. We also sent some advice on the cultivation of the wild herbs on a large scale in gardens and farms at the urgent requests of the pharmaceutical people, who knew the plants were wanted in greater supplies than the wild could offer but who did not understand their individual wants in the way of soil and so forth.

The mining industry is another important branch of the home front where valuable service has been rendered through natural history investigations, chiefly through the identification and control of fungi or molds which attack pit props and hasten their destruction. There is a great shortage of timber, due to enemy occupation of the great exporting countries in Scandinavia and the lack of American shipping facilities to export from the great Pacific Coast forests, so that anything which can be done to conserve in the consumption of our own pine trees is very useful. I was interested to find a dozen different species of fungi attacking the pit props in the mines, some of the most destructive providing their own moisture and thus attacking dry districts at the coal face. But props could be sterilized against them, and some timbers like larch are much more resistant than others, like spruce. There was also work to be done on the contamination of pit props by pine beetles carrying the spores of dry rot from one part of the mine to another, or destructive insects attacking the pit props.

Animal fodder was largely imported before the war, but because ships are now engaged in carrying foodstuffs and ammunition, hundreds of pit ponies have had to receive their share of scientific attention. The colliery owners in South Wales and Scotland have been given advice on how to balance the diet of their four-footed helpers in order to maintain their strength and health upon various substitutes making up their chaff and provender.

The record frost early in 1940 killed thousands of useful insect-eating thrushes and other birds, so that I was giving special lectures on how the population of these useful birds could be increased again by providing more suitable nesting haunts and feeding grounds. The ploughing up of thousands of acres of old grassland, golf courses, playing fields and parks for more corn made plagues of wireworms, which had to be tackled by heavy rolling and deep cultivation.

These are only a few of the activities for which you will have space. I could name many, from the problem of barnacles, which can take 20% off the speed of a 5000-horsepower cargo vessel (a serious handicap in these times of increased schedules), to the development of effective camouflage, largely copied after the methods used by various animals, for the protection of motorcars, garages, and so forth. In all these things, the naturalist has assisted unexpectedly in the wartime program.

In addition to all this there has been a great deal of spare-time voluntary work, which I think is almost as important as the more technical efforts. Helping nature study amongst our school évacués moved from the towns to the country for the first time in their lives, gave the youngsters happier memories than bombs to take back to town. We started a nature club at one village, and a village museum in another. We keep going the full activities of lectures, rambles, filmshows, and journals amongst our amateur natural history societies, universities, and museums, even in the bombed cities like London, Liverpool, and elsewhere.

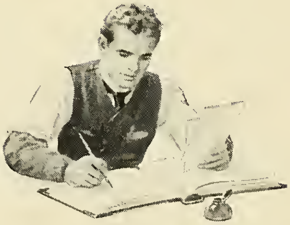
In many towns our lectures continue during air raids, except for those members who are air raid wardens, nurses, or Home Guard men, and they slip out to duty and return with the "all clear"—if it comes before morning! And by carrying on our organized nature study in the midst of the battle we believe, from the results, that such hobbies provide a welcome and valuable rest and change, however brief, from the duties and dangers of the times. It is most encouraging to find people attending a field meeting after a night on duty, or to help a refugee naturalist from Holland, France, or Czechoslovakia continue his studies, confident that when this horrible business of war is over we can again devote full time to nature in the out-of-doors and set to work conserving the wildlife and its sanctuaries which have been destroyed by this total war.

ERIC HARDY.
Liverpool, England

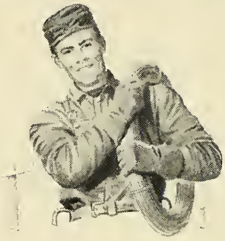
---

5 . . . where he is so expert at the frog stroke

EACH CAN SAY



"I WAS A CLERK"



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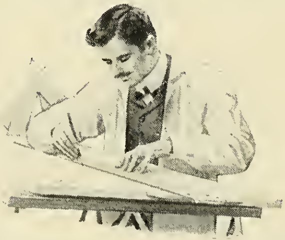

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME XLVII—No. 3 ★ ★ ★ ★ ★ ★ ★ **MARCH, 1941**

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You will find NATURAL HISTORY Magazine indexed in *Readers' Guide to Periodical Literature* in your library

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MOJAVE IN

A momentary transformation of the hard dry face of the desert into a sea of bloom—a living carpet of silver and gold, where bees are drunk with perfume and hummingbirds are enraptured by the miracle of spring

All lands that have the season we call spring have a spring flora, and wherever it occurs, it is the most innocent and ravishing of the year. I have seen some of the best on earth—the Mediterranean with its hyacinths, narcissus and crocus, the Appalachian honeyed with azalea and trillium. And the California coastal zone, where sky-blue lupine and golden poppies cover the hills and go dancing to the edge of the cliffs in sheets of color. I have read in travelers' tales that you do not know the glory of the world until you have seen the Cape flora of Africa burst forth in the antipodean spring that begins in September, bringing calla lilies, garden geraniums, gladiolus and endless exquisites of the iris family into wild unlikely being. Writes another plantsman, a world wanderer, "In variety and beauty, the flowers of the Albany district of West Australia,

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This article is a chapter from Donald Culross Peattie's forthcoming book, *The Road of the Naturalist,* published by Houghton Miffin.

Red Rock Canyon, Mojave Desert, southern California

Photo by Free-Lonce Photographers Guild

FLOWER

By Donald Culross Peattie

from August to November, surpassed anything the writer has ever seen." There full-blown orchid splendors spring from the parched soil, and insectivorous pitcher plants and great sundews spangle the sward.

That's all as may be, and I wouldn't, from anything I had seen upon the desert in many springs, have dared to hope for better. But not even on the Alps, in full summer, had I ever beheld so dancing a carpet as on that memorable April morning when I stepped out into the Mojave in bloom. Not every spring does the stone roll back like this, but only when the rain and the snows and the sun combine fortuitously to decree it. I had not seen the miracle before, roadrunner though I had been for years, crisscrossing the southwestern wastes.

Now, as anyone will cry out involuntarily at an unexpected sharp pain, so there was no stopping the laughter that rose in the throat at the sight. Not just the first time, and not just on my lips. Everyone at the ranch, each time he stepped out again into the dazzling profusion of color and dancing shapes, laughed again, a pure enchanted laugh.

The desert flora at all ordinary times consists of tough resinous shrubs, knee-high to waist-high, a few head-tall. It is grandly, confidently monotonous, made up of certain hardy species which do not hesitate to range, without apology, unvaried over an area as great as the two Virginias plus the two Carolinas. That is the norm, the always present uncompromising reality, in season or out.

Nature's tapestry

But this other visitation, this momentary translation of the hard dry face of the desert, was all herbaceous, made of tiny annuals. The sea of bloom was only ankle-deep; many species were not an inch tall, but with flowers two inches across. In this fashion the beautiful little desert stars, like English daisies, and desert-gold, tiny-tim, humble gilia with its petals the color of moonlight on frost made a dense undercarpet that it was piteous to tread upon.

Above this close undermat danced a second tier of flowers, goldenglow and white tidytips and desert dandelions with heads of canary yellow. And, pervading the whole desert with fragrance, rose the pink sand verbena, of the four-o'clock family. There was a lupine that ran everywhere, of a deep royal purple. There were the scabiosa sages, salvias really, that the Spanish settlers called *chia*, whose brilliant blue, two-lipped flowers leap out of a tiny spiny sphere of angry purple bracts. There were desert mallows, with their crumpled dusty leaves and chalices of fiery flowers varying from vivid apricot to deep grenadine.

But commonest of all, most constantly in motion on their hair-fine stems, most innocently frail, were the blue gilias. Some were clear white, some lilac, some true blue, some with yellow eyes, some tall, some dwarf, looking like many species, actually only one variable kind, *Gilia davyi*. When the wind blew and these children of the desert danced, their fragrance was blown quite away; when the sun baked perfume from the sand verbena, the gilias' odor was smothered. But when I brought them inside the dark coolness of the great adobe room, I became aware of a tender perfume stealing into my thoughts, getting into my dreams at night. Every day, every hour, you saw the gilias, but you never got used to the sheer improbability that anything so dainty could be put forth by the Mojave. Indestructible, thorny, bare, the creosote bush and salt bush, the burro brush and rabbit brush are the natural sons of the desert, warrior sons, like Homeric soldiers naked but for spear and shield, thorns and bitterness. But just as a savage man might beget gentle daughters too, so the Mojave sends forth blue gilias, once in many years a million of them, like this.

Above the two tiers of flowers there rose spindling examples of a third. Here and there, for instance, a slim wand of lilac larkspur. Or thistle sage, kingly tufts of cottony silver thick with long mauve salvia flowers, the longer for their orange anthers. And an aster with lavender heads in bold clumps of 20 blooms and more.

In all, those April days yielded to my vasculum some 75 species. Large as this number sounds, it is not a greater variety than would be found at a corresponding stage of seasonal development anywhere else; what brought delight was the sheer abundance of the carpet, the feeling that we were actually besieged by an army of little flowers. The bees were drunk with them; they came in thousands from only the Mojave knew where. I saw the hummingbirds flash by in such a state of excitement that they looked as if they had been shot sideways out of a cannon with a twisted bore. They seemed unable to settle their scattered brains on anything; they went so fast I couldn't follow them with my glasses to identify which of California's many kinds of hummers they were. We used to wonder, at the ranch, how far this flood of rare flowering washed across the desert floor. You couldn't tell; you only knew it went on to the rim of the horizon. And you knew it was brief. It must be loved while you had it, like the song of the thrush in the southern states. Something that each morning you dread to find gone at last, whelmed by the advance of summer heat.

Waves of the desert

Resting from the sweat and blindness of collecting in full sunlight at noon, I would lie on my back in the adobe room, on the cool of the tiles, and let the flowers dance before my eyes, and in my head the map of the desert unroll. Steep pitching floors, dry lake beds glistening with soda, alkaline sinks below sea level where, in Death Valley and beside the Salton, another flora sprang—queer iodine bushes, bloated and jointed greasewood, ugly arrowweed, rusty samphire. Desert ranges far to the east and north, a hundred and three hundred miles away across this blazing waste, peaks of the Panamints and Inyos and Providence Range, carrying windflowers and other sweet northern blossoms high in their stone arms, hugging them against the last of their snows under their stunted pines. Already the low desert, down by the Mexican border, would be out of flower, the last trumpet dropped from the desert catalpa, the last leaf from the straggling ocotillo.

Spring that is more than spring

And the biologic meaning of this year's rare visitation of flowers was borne in upon me. Desert plants do not follow what we consider a normal cycle—green in summer, and dying back to some perennial root in winter. For when it is calendar summer here it is biologic winter: the leaves drop and everything dies or wears the look of death. It is also, biologically, winter in autumn and winter, when snow lies on the desert. But spring is not only spring but summer and autumn in swift succession. And of all desert plants the best equipped to deal with this climatic extravagance are my little annuals, my fragile exquisites so prodigal of their scant waters. Swiftly indeed do they wilt. They not only wilt, they die, completely, the entire crop—only to survive as seeds. As seeds, a year later or, if conditions oblige, ten years later, they will sprout again, and in from two to six weeks rush to full flower, become pollinated, set seed, distribute seed, and die again. Such is the life of an annual, and of all forms of life-history the annual is the best for desert life.

For, like the seventeen-year cicada which is a grub all those years underground and enjoys but a few weeks of aerial life as a winged, singing, mating adult, the swift vanishing spring desert flora passes the greater part of its time as a dormant seed. Only irregularly and most briefly does it escape as a flower, before the continuous stream of life is caught inside a seed again, indefinitely to wait. So the champion desert plant is not the tough creosote, the malicious cholla, not the Joshua tree or the sage, but seed as tiny as gilia's. For a seed is not just part of a plant; detached, it is a complete plant, with a plantlet folded inside, a supply of food, an infinitesimal of moisture. Boxed in its shell, it defies drought, heat, cold, poisonous alkaline soils. Only water has the password to open its prison.

Now I began to notice seeds everywhere. The deliberate big harvester ants, who can both bite and sting so fiercely, were bearing away seeds of all sorts of plants, as fast as they fell, in industrious braided lines. I saw chaff outside the untidy nests of pack rats, and I presume that all of the desert's tremendous rodent population of gophers and kangaroo rats, ground squirrels and field mice are in part dependent on seeds. As seeds are the secret and triumphant desert flora, so they are the hidden larder, the basic food supply. Birds, too, devour them.

The heat, and more still the light, were often insupportable as the days crawled lizardlike across the desert. I wore a great peaked sombrero of lightest straw, and smoked glasses, sandals and white ducks and a rag of shirt. And still I was often so giddy I felt I must drop flat or die. I saw black and red before my eyes, and I measured the distance to the roof of the adobe cottage with the eye of one who has to swim back to shore farther than he is sure he has the wind or muscle to make it. The snows on the San Gabriel Range looked mockingly cool and distant as the mountains of the moon. Finally I cowered in the cool shadow of the cedar roof, writing up notes, pressing specimens, reading; and only went out at dusk.

Some come with the stars

It was then that I discovered that the desert dandelions and Mojave asters and many other flowers close up at night. And another flora, nocturnal, steals into bloom. All day long one lax and weedy plant looked dead, its flowers withered. But at night this wild four-o'clock secretly opened its rose-pink calyces and emitted a faint odor. Where I had tramped the burning blossoming swells and hollows at four and seen nothing of it, a flower called evening-snow suddenly appeared at dusk. Leaf and stem are mere sand-colored threads; flowers are twirled up by day into a pointed bud absolutely invisible in the glare. But fifteen minutes after twilight's fall, millions of them open, with a soundless silken uncurling of their petals, and lo, they are white gilias, the color of starshine. As they expand, a delicate fragrance takes the air.

The West is the kingdom of evening primroses, as it is of the four-o'clock family. Though I knew many species of evening primrose, still I was unprepared for the great dune primrose I found in the desert dusks. Its crepuscular flowers are large as those of a wild rose when they open, but insubstantial as spider floss, great mothlike petals languidly opening as if still oppressed with the long siesta of the day. They are white, but as soon as you pick them they turn pink, and in ten minutes they are faded and cannot be revived. They seem to have just the requisite turgor in their gleaming cells to sustain life only if they are not sun-smitten or touched by human hands. They are so secret that they cannot survive the appreciation of a fingertip, and they hold their sweet breath until the approach of darkness.

I left the ranch in mid-April, wanting not to see this rainbow fade. Early in May a friend wrote:

"Come back; there is another flora on the way." It was easy to leave my desk at that. Gone was the first candor of the early flowers, and in their place had come a gaudier, coarser, stronger flora, corresponding, I suppose, to those of eastern summers. Yellow buckwheat was everywhere, and another flower, called "alkali goldfields," had replaced the coreopsis. A sort of branching dandelion took over from the desert dandelions; the strange rock pink was in flower, and the desert trumpet, too, and it was the season now of *el barbasco,* the fish-poison spurge, and *Stillingia* spurge with angry red spikes, that gushes a spurt of milky juice upon the hands in revenge for being picked. The beaver-tail cactus was glowing with its deep rose cups. Where the sunlight blazed the fiercest, where the hard sands reflected its intolerable glare, there burnt up from the ground an almost stemless cup of fiery orange. It is something to look a desert mariposa in the eye. You find mariposas all over the West, changing height, changing shape and color, as you trace them from the mountains of Colorado, over the Utah deserts, up and over the high Sierra, down into the great Central Valley, climbing the coast ranges and descending till they dance on the brink of the sea cliffs of the Pacific. They change names, too—fairy lanterns, Mormon lilies, cat's ears, *Calochortus.* They are lilac and pink and white; they are like white tulips, delicately penciled and blotched; they are like dainty fritillaries, nodding cup half closed. Nothing you ever saw of them prepares you for the desert's one species, for that intense cup of flame. And within the orange petals stand clear the six chocolate-purple anthers and the elegant long erect ovary, neatly three-angled and clean straw color.

Prickly and inhospitable

The ground was prickly now with inhospitable kinds of gilia—prickly gilia and calico flower. Underfoot were the little spiny-herb, all ridges and prickles and points, symmetrical on a plan of three; and a relative that looked as if it had been cut out of tarnishing metal by Euclid. At the center of its saucer of bracts you find what looks like a clutch of tiny seeds, only to discover that they are really the larvae of a beautiful little blue butterfly.

In the innocent phase of spring there had bloomed a sprawling *Astragalus,* very like a lupine, but straggling, crazy, dusty, with a sickly pink bloom—locoweed of the cowboys. Out of flower now, its great inflated pods that popped when you touched them were bloated and blotched and scrawled with an alphabet without meaning, in madders and purples and garnet lines. Loco, that drives the horses mad, that kills them with its deadly chemical selenium.

The paper-bag bush, too, was now in pod, just a few of its purple mint flowers left, where I had seen the hummingbirds at pollination. The hop-sage was turning red, as if with autumn tints; the color of the fruits upon the Mormon tea was trembling between rose purple and rose pink; bronze was overcasting the saltbush foliage, and out on the desert burned the last unholy glories of its ultimate flora—*Nicolletia,* with off-shade yellow pinks and mustardy green yellows and a skunky odor that simply would not wash off the fingers, also a brassy-colored *Dyssodia* with a name which means "ill-smell," thrice and four times deserved.

Smiling desolation of autumn

The desert at last had bloomed itself out; it had exhausted the gamut of beauty and, like a decadent, found beauty in the repulsive. By June, when it was true summer elsewhere, the Mojave was already far gone into the smiling desolation of its autumn. I would not even look at the brittle dusty yellow straws that were the stubble of the blue-eyed jillies. Life was going off the land; even the meager foliage of the shrubs was dropping, leaving naked thorns. The wasps were beginning to come out of the inflated stems of the desert trumpet, where their mother had laid them when that stem was succulent and bore flowers. It was so paper-thin and brittle now it broke at a touch; no sound was in its parched throat, no humming reveille in the trumpet. There was nothing anywhere, from the foot of the San Bernardinos to and beyond the Colorado River, except heat and wind, and sand upon the wind, and blinding light. The color had seeped out of the world—the laughing tints, the fiery hues that followed—, now there were the eternal desert ochers and grays, the washed-out rusts, the silvered stalks, the horizons dancing with heat waves. The desert had forgotten its one relenting tenderness; it had gone back to the vast inertia of being desert, as dryly and sternly itself as an old squaw. Even at 10,000 feet the snows on the San Gabriels were gone; they, too, were but winter's intercession. They were not eternal. The dew was gone from the mornings, each day a little less, until at last there was no sip for a linnet; the song of the orioles was silenced in the Joshua trees, the birds were hatched, the brown pouch hung empty. It was time for my departure; the desert itself seemed to be driving me out. I did not know when I should get back again. And when if ever I should see it bloom once more.

Photo by Padilla Studios

THE *FRIENDLY* DESERT

By Charles Alma Byers

Know your desert plants, and their beauty will open up a new world of enchantment

Deserts are commonly visualized as regions that are barren and worthless. Indeed the familiar dictionary definition is, "a region without vegetation." This idea, however, is more often mistaken than not, when applied to our American deserts. There are, of course, certain parts which are quite devoid of vegetation and where drifting sands rule supreme; but for the most part our desert lands support a much more abundant growth than is generally realized. And, contrary to common belief, the soil itself is often some of the most fertile in the world, so that when it can be given enough water it is surprisingly productive.

Early maps of North America labeled a vast area in the West, "The Great American Desert." The idea became established that something almost comparable to the Sahara existed out there; and only with the development of our modern railroads and highways has the Great American Desert shrunk to a few scattered areas. Private and governmental reclamation work is further constantly rescuing the desert from neglect; so that real desert conditions exist only in such spots as the Arizona Desert, Yuma Desert, Great Salt Lake Desert, Ralston Desert of

Nevada, Colorado Desert of California, Mojave, Death Valley, etc. And nearly all of these regions, even some of the most desolate parts of Death Valley, have their forests—of a kind.

The strange ways in which Mother Nature overcomes handicaps are nowhere better shown than in the vegetation of the desert and the semidesert. Here plant life must ever battle against endless drought, against scorching summer suns, harassing winds, and restless sands. There is little wonder that it is often fantastic in character and seemingly dwarfed in size. Yet it is also wonderfully beautiful.

FROM THE SPEEDING automobile or train, one does not realize that the desert lands of the United States contain an assortment of strange plants native to these American wastes and, in general, seen nowhere else on earth. Our native desert plants gave the Indians a wide list of useful products—fruit, beverages, medicines, clothing, and building materials—, as explained on the following pages. And the beauty of the whole is found on closer inspection to be built up of a number of fascinating parts, each displaying its characteristic form and colors.

The photograph at left shows the Colorado Desert of California. Here, as well as in southern Arizona, grows one of our strangest and showiest desert trees, the paloverde, illustrated below at close range.

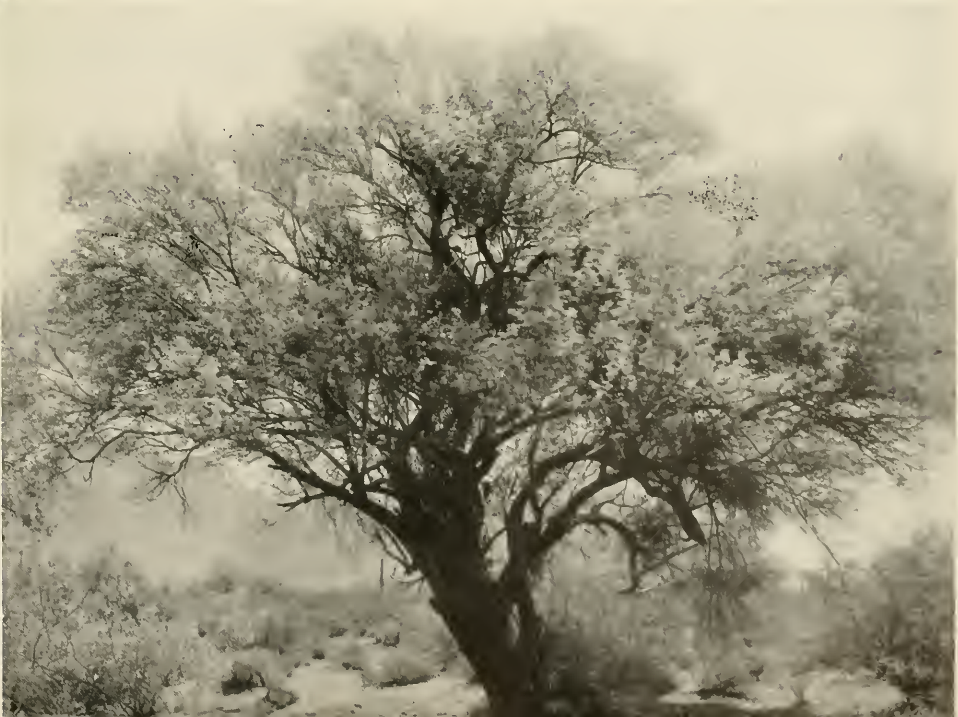
THE DESERT IS *BEAUTIFUL*

Viewed through air that is crystal-clear, landscape tints seen nowhere else lend a weird enchantment to this world of purple and gold. Yet the full beauty of the desert, overlooked by the hurried traveler, requires closer observation.

(Below) A GLORIOUS ARRAY of bright yellow bloom is put forth by the paloverde in March. The tree then becomes a study in brilliant gold, set off against the quiet green of its tiny oblong leaflets. The flowers are about the size of buttercups and produce a general effect resembling Scotch broom. The seeds, in pods two or three inches long, fall in July and are harvested by the Indians for food.

The name *paloverde* is Spanish for "green tree" or "green wood," for the bark of the entire tree, including even that of the main trunk, is light green and presents a strange appearance against the usual parched-brown background. The scientific name is *Cercidium torreyanum* (formerly *Parkinsonia torreyana).*

Photo by Putnam Studios



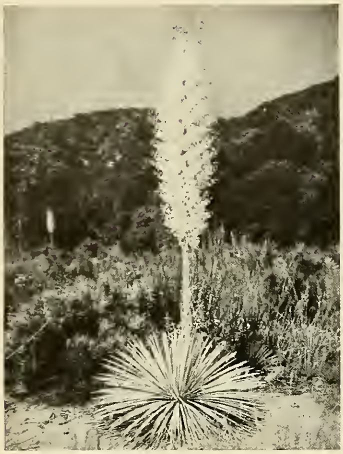


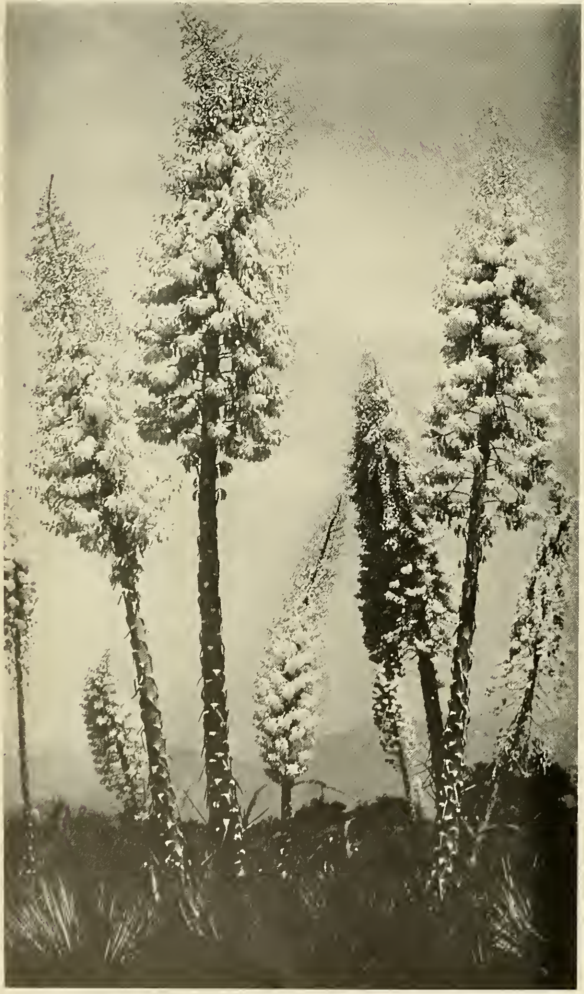
Photo by Padilla Studios

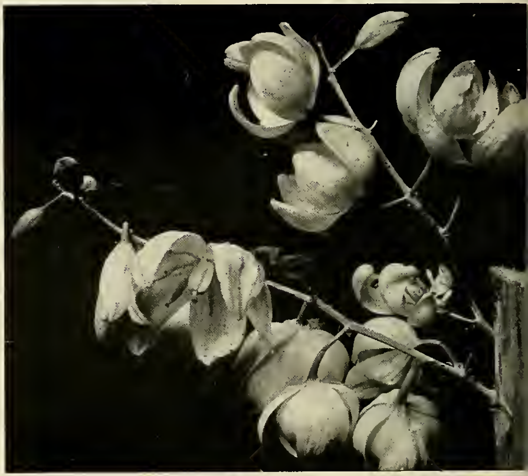
AT BLOOMING TIME the Spanish bayonet *(Yucca whipplei)* becomes a thing of glory and splendor. Previously only a sort of plant-life hedgehog, formidably armed and unapproachable, it now sends up from its center a tall "candle" of snowy-white blossoms—a shaft of light and marvelous beauty that can be seen and identified for miles around. This shaft is lifted to a height of ten or fifteen feet, and along one-half to two-thirds of it is a gracefully bulging cluster of bloom. The base, a symmetrical mass of living bayonets, blue-green in color and each terminating in a hard point as sharp as a needle, remains on guard, but now the plant deserves its other name, the "Lord's Candle." Making its debut at the season when much of the other vegetation is turning brown in the summer heat, it presents a striking picture, spectacular and queenly by day, and specter-like in the light of the moon—a ghostly sentinel.

The flower stalk usually begins to grow about the last of April or the first of May. Leafless and blue-green, frequently with a reddish tinge, it rises rapidly, gradually swelling. The usual blooming season is in and around June.

The Spanish bayonet is one of the most interesting of several kinds of yucca native to North America. Its home, strictly speaking, is not the real desert, but the chaparral-covered semidesert of the Southwest. It is abundant in various sections in southern California and is found also in Mexico and Central America.

Photo by Charles Alma Byers





(Below) THE SMOKE TREE: a desert ghost which dons a regal cloak once a year. For many months the smoke tree *(Parosela spinosa)* is completely devoid of foliage and apparently lifeless. Then in late spring, as if awaking reluctantly from its slumber, it puts forth a thin sprinkling of small, narrow leaves, and suddenly, about the middle of June, it bursts into wondrous bloom. Its garb is no longer that of a wraith, but of a mantle of the most glorious ultramarine. The

Photo by Padilla Stu

(Below) THE "FLAME" of the Lord's Candle is made up of waxy, cream-tinted white flowers, sometimes with a tinge of purple, one or two inches in diameter.

Pollination of the blossom of this strange plant is seemingly left by nature almost entirely to a little white moth, whose larvae live on the seeds. This moth, first gathering pollen from several flowers, lays its eggs in the deep-set ovary and then pushes its assembled supply of pollen, rolled into a tiny ball, down into the blossom until it rests against the stigma. After blooming, the flower stalk turns grayish-white but often remains standing throughout the summer and fall—a sort of memorial to the yucca's one-time glory.

Photo by C. C. Pierce

"indigo bush" then soon sheds its foliage and again becomes a ghost.

The smoke tree is apparently the desert's very own. It loves the hot and sultry canyons but is occasionally found straggling forth even into the desert sands.

This might be called the "desert vamp" or "vampire"—"vamp" in the sense that it will lure man with false hopes by the appearance it gives of smoke lazily rising from a campfire; and "vampire" in the sense that it is likely to draw one's blood. Its spines, indeed, are so sharp and numerous that it is sometimes referred to as the "porcupine tree." Its slender, graceful limbs are also covered with a sort of fine, cottony fuzz.

A BANQUET IN THE DESERT

It would be a weird banquet, but if all the plant resources of the desert were gathered together, the diner would not go hungry nor lack variety. The meal could be eaten under candlelight produced by the candlewood tree. And the desert would also give soap to wash with, utensils for cooking, and even protection against its breezes, which can be surprisingly cold at night.

CANDLES. It is from the fantastic ocotillo, or candlewood *(Fouquieria splendens)*, whose branchless arms are rich in wax-like resin, that actual candles may be made. The wood readily burns with a steady blue flame, much like a wax paper.

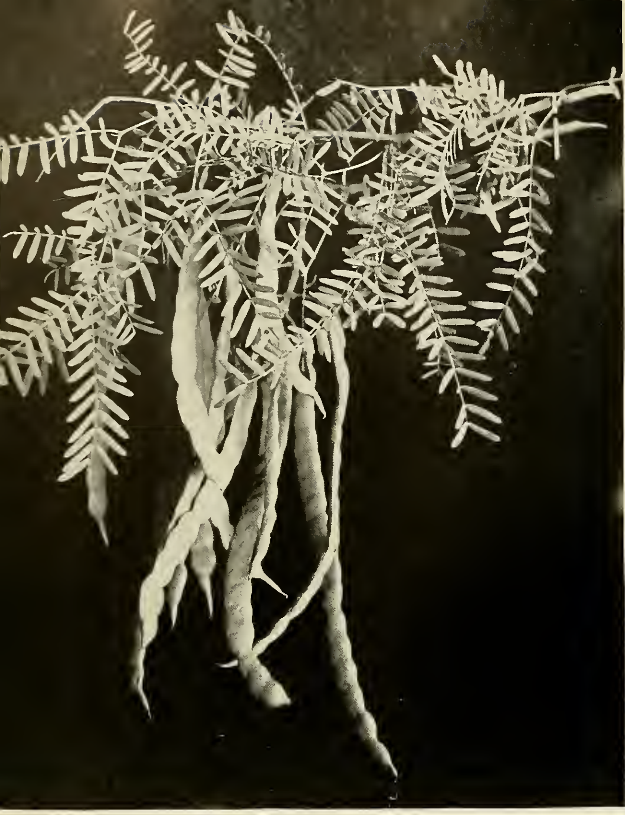
Photo by Putnam Studios

In spring each arm tips itself with a cluster of bright scarlet flowers, and the general effect is then like a bunch of long-staffed flaming torches. The ocotillo is very easily propogated by means of cuttings and is frequently used by Indians in making hedges and corral fences. The plant grows from fifteen to 20 feet high, and is native to sections of California, east to Texas and south to Mexico, thriving frequently on some of the most desolate wastes.

THIRST need have no terror for the desert traveler where the barrel cactus *(Ferocactus acanthodes)* grows. This "water barrel" of the desert has saved the life of many a thirsty wanderer. Approximately 90% of its total weight is water. When the top is cut off, the interior is found to be a firm, white, watery pulp, which, when crushed with a stone and then squeezed in the hands, yields its fluid. Indians made use of the juice as a drink and sometimes utilized the hollowed-out trunk as a cooking pot, boiling their foods in it by dropping in hot stones. White man has learned to make a very delicious candy from the pulp.

This cactus is called "bisnaga" or "visnaga." In early summer, it gives out a magnificent crown of several large greenish-yellow blossoms. The barrel cactus is rather easily toppled over, having little more than a long, slender taproot. To disturb this valuable plant unnecessarily is an offence against the laws of conservation.

Photo by Putnam Studios



ONE OF THE FRIENDLIEST growths of our arid regions is the mesquite. Beneath its spreading branches the desert traveler finds shade, and from its seed pods both man and beast may obtain wholesome food. And if your desert banquet is at Christmas time, you may decorate the table with mistletoe from its branches, which is seen growing on the mesquite below. This is the screw-bean mesquite *(Prosopis pubescens)*, which bears clusters of screw-shaped bean pods. Our other well-known mesquite, the long-bean kind *(Prosopis juliflora* var. *glandulosa)*, bears the four- to eight-inch bean pods illustrated at left. Indians gathered the beans in large quantities and ground them into a meal from which they made a sort of mush. Even the pods were often prepared into a highly-prized black dye, and from a gum which a wound in the tree exudes they made both mucilage and medicine.

Unlike the barrel cactus, the mesquite has been known to send its roots in search of water to a depth of 60 feet. One or another kind of mesquite is found from Utah and Kansas to Mexico and from California to Texas.

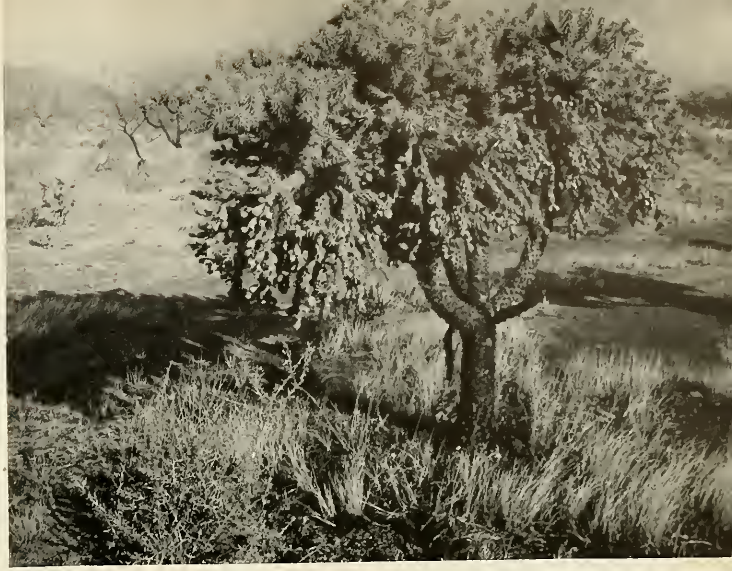
Photos by C. C. Pierce

(Right, below) THE GIANT CACTUS *(Carnegiea gigantea)*, or saguaro, bears fruit which the Indians prize as a delicacy. Indeed the Papagos make a great annual festival of its harvesting. The purplish-red fruit, maturing around the end of June, is roughly egg-shaped and contains, when ripe, a soft, red pulp with numerous small black seeds. Much of the fruit is eaten fresh, and some is utilized for making a rich wine. From most of the fruit, however, if the year's crop be large, they extract the juice and boil it down to a molasses-like syrup, which they store in earthen jars. They even preserve the seeds, which they grind and make into mush. The older portions of the trunk encase a number of long, slender poles, suggestive of bamboo fishing rods. These the Indians use as carrying poles and for framework of papoose cradles, and otherwise.

This cactus reaches a height of 40 or 50 feet and a possible thickness of nearly two feet. But a ten-year-old giant cactus is rarely taller than five inches. Some of the oldest ones are estimated to exceed 200 years in age and to weigh six or even eight tons.

Woodpeckers peck holes in the giant cactus and build their nests in them, and the cactus usually adjusts itself by lining these pockets with a special callous-like growth. However, the woodpeckers do not keep permanent ownership of all these holes, and many become occupied by the elf owl, said to be one of the smallest known species of owl. The giant cactus is found in Arizona (notably near Phoenix), in southeastern California, and in Sonora.

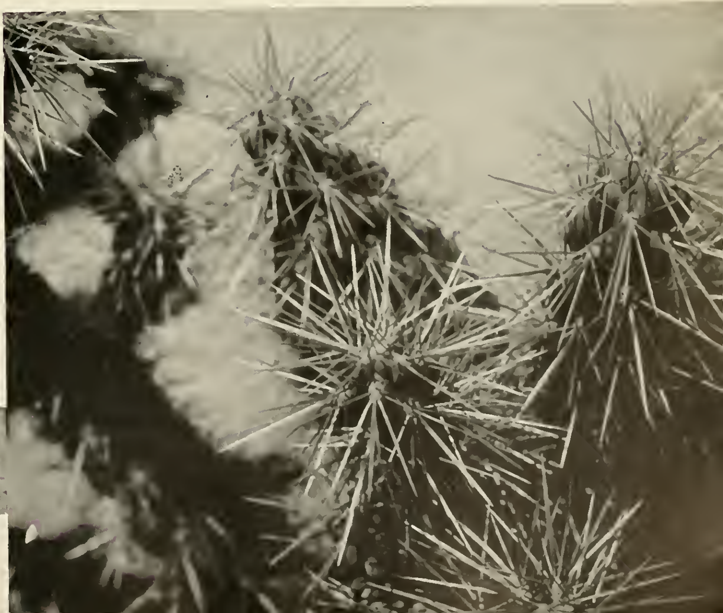
Photo by Padilla Studios



THOUGH the cholla cacti (pronounced "choy-a") are the most shunned, they too produce edible fruit. The fruiting of the *Opuntia fulgida,* above, is especially interesting. Its cup-shaped fruit is yellow, and one fruit seems to spring out of another in haphazard fashion, to hang in long chains. A close-up showing the less friendly features of this cactus is seen below. Its flowers are light rose color.

Most cacti classed as cholla are a bristling mass of needle-like spines. The spiny joints, somewhat suggestive of superferocious chestnut burrs, become detached by a mere touch—often from a gently stirring breeze. Indians and many Mexicans hold to the belief that they actually jump out at the passer-by, hence the nickname, "jumping cactus." To be sure, one can scarcely pass through a thicket of this cactus without finding one or more of the joints clinging to one's clothing. Pack rats frequently use the barbed joints to build a bulwark for guarding the entrance to their home, and how they succeed in carrying them borders on the incomprehensible.

Photos by C. C. Pierce



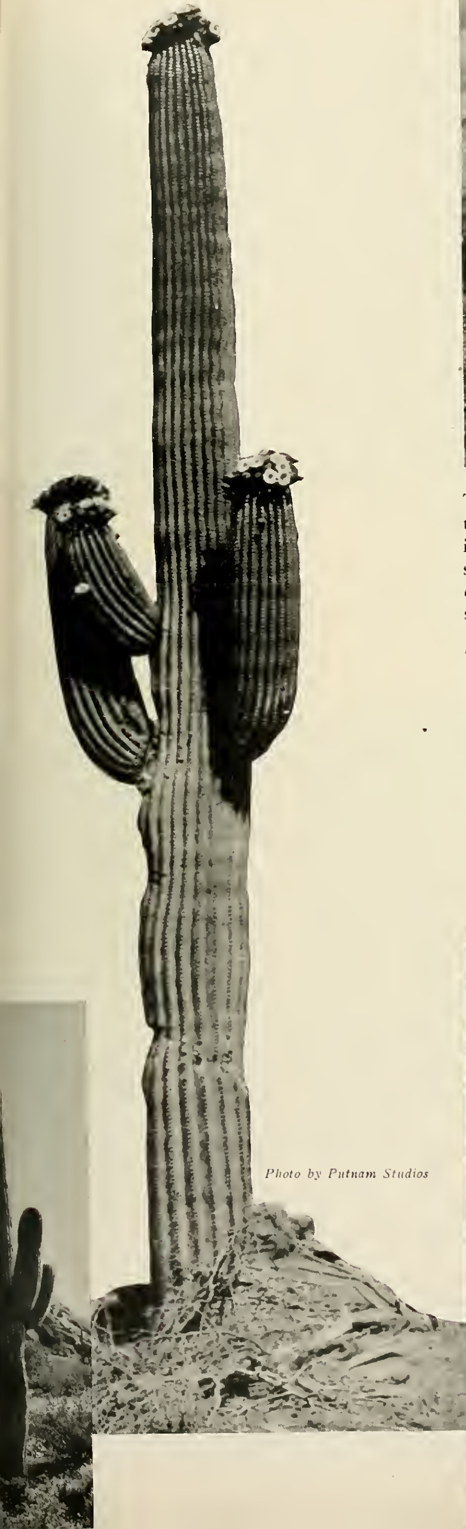


Photo by Putnam Studios

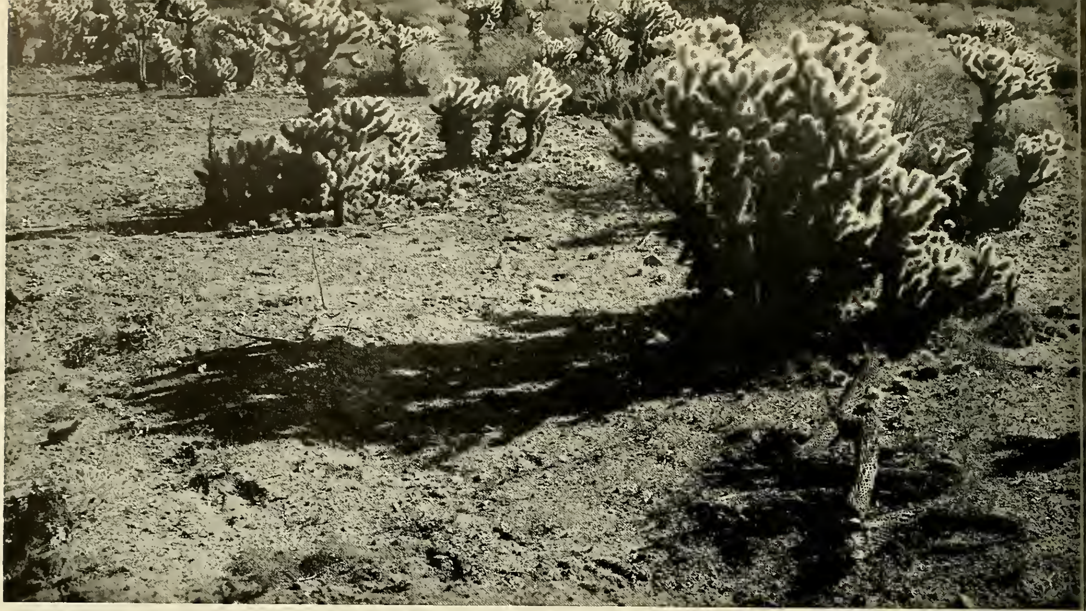
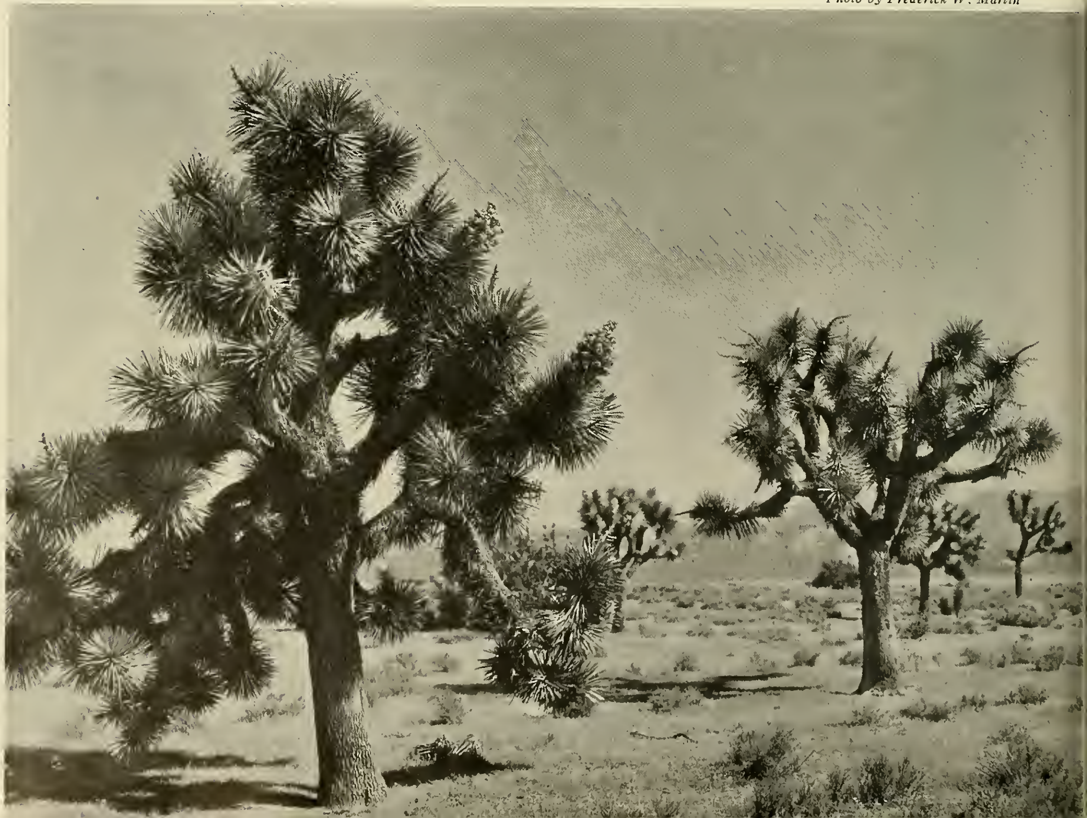


Photo by Padilla Studios

THOUGH FUZZY-LOOKING from a distance, one does not want to collide with *Opuntia bigelovii* after dark. Several species of cylindrical-stemmed opuntias received the name cholla. The most conspicuous are the ones shown above and on the preceding page, and two others: *Opuntia echinocarpa,* native to the Colorado Desert (yellowish flowers with red-tipped sepals), and *Opuntia acanthocarpa,* which thrives about Needles, Arizona (pale yellow blossoms with orange-yellow pistils).

Photo by Frederick W. Martin



FROM THE LEAVES and twigs of the creosote bush *(Larrea tridentata* var. *glutinosa)*, at right, the Indians brewed a bitter tea (which they used as a sort of tonic) and made a liniment for healing wounds and for relieving rheumatism. Moreover, this bush yielded a yellowish-green dye, and its sap gave them a kind of cement employed in making bows and arrows.

The creosote bush inhabits the desert of almost the whole of the Southwest, from the low-lying foothills to the very heart of Death Valley. The gray stems are marked at all branch joints with blackish knots, producing a curious banded effect. At the blooming season the bush puts forth myriads of bright yellow flowers, nearly an inch across, with greenish-yellow sepals. Later come innumerable seed-balls—white, fuzzy, and silky. Being evergreen, the creosote bush lends a restful color to the desert throughout the year.

Photo by Charles Almo Byers

MOST FANTASTIC and individualistic of all our desert plant-life is probably the Joshua tree *(Yucca brevifolia)*, shown at left and right. And, strange as it seems, it belongs to the lily family. From gawky youth to decrepit old age, it passes from one grotesque form to another. In the sapling stage it is a clumsy, shaggy shaft with a green topknot of dagger-pointed leaves. At a height of from eight to fifteen feet it puts forth its first branch, adding others thereafter until it becomes a full-fledged tree. When eventually old age creeps upon it, it begins to writhe and twist like a contortionist, until weary and weazened, its arms commence to sag. Then one day there comes a gust of wind, and the tree lies prostrate in the sand. A grove of Jushua trees seen at night under the light of a full moon is weird and uncanny—a garden of plant-life gargoyles in silhouette.

Yet the Joshua tree is not always a thing uncouth. In the late spring or early summer, the spiked tip of each contorted arm sends forth a ponderous cluster of pallid, greenish-white flowers, each nearly two inches across, which have a clammy smell suggestive of toadstools. Then the tree becomes a thing of real though fantastic beauty.

The yellowish fruit which follows was relished by the Indians as a food, and they used the fiber from the leaves for weaving baskets, ropes, and other articles. And—as if to prove its versatility in a region supposed to be devoid of all comforts—the stems provided a pulp which the Indians used for soap.

The wood of the Joshua tree, spongy, tough, and pliable, is quite extensively used for making surgeon's splints and to a less extent in the manufacture of artificial limbs.

The Joshua is a true, loyal child of the desert and is found in the arid sections of Arizona, Utah, and California, especially in the Mojave Desert. The finer specimens are 25 to 30 feet high.

Photo by C. C. Pierce

© by Biskra, Coachella Valley

EVEN the stately desert palm *(Washingtonia filifera)* serves man. Although the meat of the berries is too thin to be of any great value, the Indians formerly utilized them for food. Also they use the leaves *(below)* to this day for purposes of thatching. The small, yellow-brown berries, each with a proportionately large, brown seed inside, are borne in clusters from eight to twelve feet in length.

Popularly known as the Washington palm in honor of our first President, the average height of these trees is from 30 to 50 feet but many of them tower to 80 feet or more, and the columnar trunks sometimes measure nearly three feet in diameter at the base. The petticoat effect is formed by the old leaves, which gradually turn brown and droop against the trunk. In a natural state they clothe the trunk with a heavy skirt but in most cases fire has destroyed much of this covering, strangely with no apparent damage to the tree itself.

This picturesque tree is probably one of the oldest of our desert plants and may have lived where it does before the desert came. According to this theory, it is a "hang-over" from a time when a great inland sea covered much or all of that part of California now designated as Salton Sink. Thus the large, fan-shaped leaves which now rustle in the hot, dry wind from off the furnace-like sand, may once have gently swayed in cool, moisture-laden breezes blowing across a nearby sea.

The Washington palm is found wild principally in the western portions of the Colorado Desert of California but is scattered as far south as the Gulf of California in Mexico.

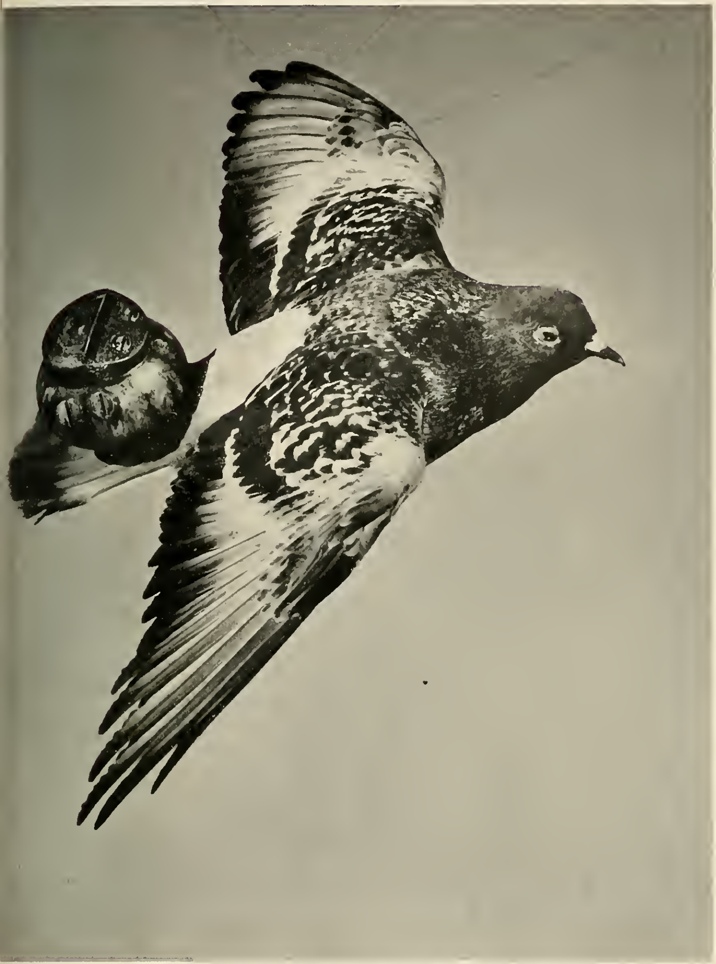
In many curious ways the plants of the desert have adapted themselves to life under conditions of extreme heat and dryness, yet in the process they have not lost their usefulness. Queer, grotesque, and often dwarfed, they ever seem ferociously on the defensive, yet they yield their manna to man, and to his aesthetic sense they lend their peaceful beauty.

Photo by C. C. Pierce

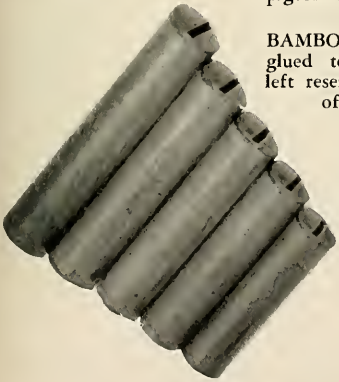
WHERE PIGEONS WHISTLE

Past masters of delicacy in the diminutive, the artists of China have given the world an amazing variety of charming bibelots. The pigeon flutes displayed on this page are excellent examples of their peculiar inspiration, and it seems unlikely that any other people would hit upon the delightful notion of making their pet birds fly to the strains of music like that of an aeolian harp.

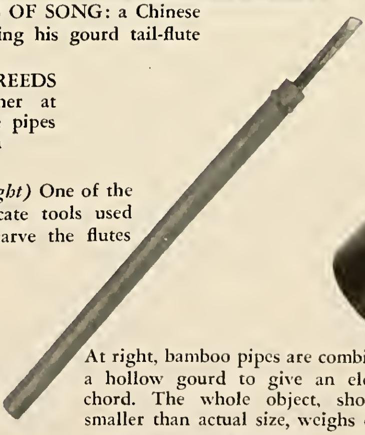
Pigeon raising in China is of ancient origin, but the tail-borne flutes date from 1662. Before that time, small silver bells were used to scare off hawks. Once invented, the flutes evolved rapidly, from a single-noted pipe to complex devices like the one immediately below, which combines a hollow gourd with ten bamboo cylinders each playing a different note. Accurate measurements and individual fittings were necessary to ensure a correct angle against the wind before the flute was attached to the pigeon's tail feathers by means of a metal ring. Smaller flutes produced higher notes and were reserved for female birds. Chinese daintiness also directed the convention of carving flutes in pairs and calling them male and female.



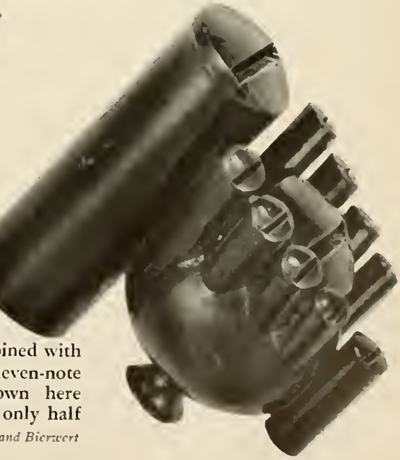
ON WINGS OF SONG: a Chinese pigeon wearing his gourd tail-flute



BAMBOO REEDS glued together at left resemble pipes of Pan



(Right) One of the delicate tools used to carve the flutes



At right, bamboo pipes are combined with a hollow gourd to give an eleven-note chord. The whole object, shown here smaller than actual size, weighs only half an ounce

AMNH photos by Coles and Bierwert

TOO CLOS

By Robert H. Rockwell

True bear stories that show what you might expect

Tales of adventure have charmed us all at a very tender age. Our earliest childhood interest was often stimulated by a thrilling bedtime story, when we were regaled and often terrified by blood-curdling yarns of being chased by bears. Whether these stories were true or not made little difference at the time. We liked to believe them and pass them on from one generation to another, often adding our own version of startling details with a more or less Machiavellian touch.

But it is not without reason that a reputation of ferocity in bears has come down through the centuries, perhaps from as far back as primitive man, who probably had to defend himself against the huge, prehistoric cave bear with crude and ineffective weapons. The advent of accurate firearms in modern times has had some effect in modifying the aggressiveness of these large carnivorous beasts, but even today bears may truly be considered dangerous animals. In fact, more dangerous than any other game in North America.

It should not be inferred, however, that bears are bloodthirsty monsters. In most cases they prefer to retreat out of man's way; but when aroused to anger or when wounded they sometimes attack with devastating fury, and occasionally with fatal results. In a wild state bears do not appear to possess any craving for human flesh. Unlike the man-eating tiger or lion, they do not lie in wait to pounce on people from ambush. Of the seven brown bears I hunted on previous expeditions in Alaska, none made any effort to charge, but even so, this was probably a matter of luck. All experienced woodsmen have wholesome respect for bears, whether they are brown, black, or polar, and especially a she-bear accompanied by a pair of young cubs.

Last summer our party of four, under the leadership and sponsorship of Mr. Richard K. Mellon and operating from the yacht *Electra,* hunted on the islands of Baranof, Chichagof and Admiralty. Fifty-two bears in all were sighted, and several fine specimens were procured. While most of these were killed at fairly close range by well placed shots, obviously eliminating the possibility of a charge, to say that there was no excitement on the trip would be far from the truth. Each encounter had its quota of thrills and disappointments, all of which furnished no end of after-dinner talk and good-natured banter, which often continued far into the night.

On board the yacht a spirit of good fellowship prevailed. Our crew of five was adequate; each one seemed to enjoy his job. We had a good captain on the bridge and a skilled chef in the galley. Formalities were cut or discarded when we cast off our lines at the dock in Ketchikan.

Of several fascinating incidents that I recall, one occurred when the bear came walking up to the hunter instead of the hunter trailing the bear. Dick Mellon and Bruce Johnstone, his guide, had spent most of the morning exploring the shoals of a salmon stream with few signs of bear in evidence. They had pulled their canoe past an eddy into quiet water, tying up against a long, half-submerged log. As it was near noon, they ate their lunch, had a smoke, and kept a sharp lookout for game along both sides of the stream. Close to their canoe, a narrow, elevated bank projected well out into the water, commanding an excellent view. Here Bruce stepped ashore into the timber, leaving his gun behind, and stationed himself on the extreme point, where he then sat down at the base of two huge tree trunks. The day was warm, and Dick in the canoe dozed, but he was suddenly awakened by the sharp snap of a breaking branch. Looking up 20 feet above him, he was startled by the cause of the commotion!

Close by, a large male black bear was deliberately walking along the margin of the bank and had almost reached the spot where Bruce was sitting unarmed and entirely unaware that a bear was snooping about, almost looking over his shoulder! As the bear raised his head to make a further advance, Dick picked up his rifle from the bottom of the canoe. At the echo of the first shot, the bear rolled over into a depression on the opposite side of the bank, while Dick scrambled quickly up the slippery slope and pointed his gun downward, killing the growling animal among the tree trunks directly below him. Bruce, with a smile of relief on his face, emerged from behind the tree and retrieved his gun.

Mrs. Mellon probably came as close to a bear as anyone would want to be. She was walking one day, near some high grass on the densely wooded bank of a rocky stream, when her guide heard a noise close by in some high, tangled vegetation. They both advanced, with Connie holding her rifle ready. Just then three brown bear cubs scuttled out almost under their feet from the underbrush. One climbed a tree over their heads and started crying for its parent. Very soon the bushes began to weave and snap near them, and presently the big head of a she-bear emerged, growling and champing in a most menacing manner. Mrs. Mellon started to take aim at the head, which was not

TO BEARS

of America's most formidable animals at close range

more than fifteen paces away, but her guide stepped directly in front of her, yelling, "Don't shoot, don't shoot!" The bear slipped back into the brush, her cubs followed, and that was the last seen of them. None of us blamed Mrs. Mellon for being perturbed by this interference of the guide, but it created a humorous byword on board: "Don't shoot, don't shoot!"

Many sportsmen will agree that the last day of a hunt, sometimes the last mile on the way back to camp, has produced luck and thrills beyond their most hopeful conjecture. Dick and Bruce were not overexuberant when they left the *Electra* in their outboard motorboat on the final day of the hunt. Their motor made a loud racket which echoed from the close cliffs as they headed towards Walker Cove for black bear. It was early morning when they reached the river. Overhead, white cloud banks hung in long, fleecy streaks half way up the steep mountains, as their boat entered the smooth waters of the river. They came to anchor on a wide verdant delta where sleepy flocks of gulls walked listlessly about and wailed in a melancholy manner. The tide had fallen and great schools of silver salmon were clearly visible, working up stream in the shallow water on their way to gravel spawning grounds and to the end of their cycle of life, for after spawning they die. There seemed to be as many dead fish as live ones; the banks reeked with the stench of their rotting bodies. Every pool and riffle was actually crowded to capacity. Some were lively but were changing color, some were fighting each other to guard the spawn. Others appeared in all the various stages of decomposition with their fins frayed, their bodies bruised, rising half out of the water, gasping and swimming aimlessly about, struggling against a relentless fate that had sent them to spawn in the same stream in which they were hatched. Now that their mission was completed nature decreed that they should die.

Bruce surveyed the banks and sand bars without finding fresh signs of bear. The track of a man's boot showed up in the sands, which, Bruce explained, was probably the footprint of a hunter of seals and eagles. These lonely wanderers find their way into every cove on the Alaskan coast. The Government pays them three dollars bounty on every seal head-skin and one dollar on every pair of eagle feet. They are mostly men who are bored with civilization and prefer to garner a meager existence in the wilderness. Human tracks in the sand were not reassuring to Dick or Bruce. They figured that the seal hunter might have had a hand in reducing the bear population in this section of the country.

About a mile up the river they sighted two black bear cubs playing on a sand bar and catching salmon in the riffles. These two husky cubs were having sport with the salmon. They ate a bite from each fish they caught, left it on the bank, and then dashed into the water after another. Screened behind spruce trees, Dick and Bruce watched these "babes in the woods" as they played and fished with as much pleasure as small boys. The cubs seemed to be on their own. Bruce concluded that since the parent bear was nowhere in evidence, she might have been shot, and that here were two orphan cubs starting out to shift for themselves.

The hunters moved closer; the cubs, seeing them, became badly frightened, rushed for the dense timber and very quickly climbed a 40-foot spruce that grew out of a projecting mound of earth and massive, moss-covered logs. With rifle ready, Dick circled one side of the mound close to the tree up which the bears had climbed. Bruce went around the other side. Thick brush held them back and huge hemlocks overhead darkened the ground below. Dick could not see what happened but he heard the loud report of a gun on Bruce's side of the mound. For some moments everything was quiet, and Dick concluded that Bruce had probably fired to scare the cubs higher up the tree. He climbed up over the mound, and a ghastly sight met his eyes.

Bruce was down on his back in a shallow mudhole, with his rifle under him and a bear on top, snapping at his face. With only his bare hands clutching the animal's lower jaw and the hair of her right cheek in a death grip, Bruce was holding the head away from his face and yelling to Dick: "Shoot, shoot quick! I can't hold her much longer!" With prompt decision, Dick put the muzzle of his Springfield close to the bear's shoulder, but noticed Bruce's leg sticking out underneath the bear in direct alignment with the rifle barrel. With a quick change, he lowered the butt of the gun and poked the muzzle up under the bear's throat, firing upward into the brain and killing her instantly.

Bruce's face and hair were covered with blood, and Dick thought the bear had about finished him. He at once rolled the bear off; and it was some time before Bruce recovered from the shock and struggle. But strange to say, aside from a sprained knee, there was no other injury on his body. All the blood on his face had poured out of the bear. Bruce had shot her

TOO CLOSE TO BEARS

Continued from preceding page

over the left eye. It was a damaging blow, but not enough to stop her charge. Dick's cool, deliberate action changed the course of events, which might have had a tragic end.

Almost two hours elapsed before Bruce was able to move about with his sprained knee. The encounter had given him quite a jolt, but he took it all in a calm, undemonstrative mood. After summing up briefly what happened, his only remark was, "You know, we get too d—n close to these bears."

While Dick made a hurried trip to the yacht for help, Bruce rested under the tree that the cubs had climbed.

Later five of us left the vessel with an outfit of ropes and other equipment to take the cubs alive. The problem was to make the capture without any injury to the bears and without getting clawed or bitten ourselves. This did not prove as easy as it seemed. They were strong, healthy animals, weighing about 50 pounds each. They fought us tooth and claw, with amazing ferocity. There was considerable confusion around the "bear tree." Each of us had a different plan, but our chief officer, Raymond Veatch, presented the most effective device, which was a lasso on the end of a ten-foot bamboo pole. At first the cubs looked down on us with calm indifference. As the lasso was put over their heads, they either leaped through it, or dived past it among a maze of branches. It seemed like a hopeless procedure until the smaller of the two cubs became alarmed and, descending the tree backwards, tried to make his escape. Veatch grabbed him quickly by the scruff of the neck. I held his left legs, and the mate grabbed his right legs. His efforts to get hold of us were terrific. He was a picture of outraged fury and he snapped at everything that came within his reach, even biting holes in the Captain's rubber boots. It required five of us to hold him down. We tied his feet, and I made a muzzle out of two-ply, heavy codfish line, fastening it over his jaws so he could be carried to the beach.

Then we went after the larger cub. He was stronger and even more difficult than the first. In the tangle of spruce branches, we encountered great difficulty in getting the noose over his neck. Time and again he flipped it aside amid unprintable ejaculations on our part. Just as I was about to climb the tree, Veatch made a lucky pass. The noose tightened, but in the struggle that followed, the bear became strangled, and when we lowered him to the ground he passed out. I quickly loosened the rope. His paws were limp and his eyes glassy. I gave him first aid by working his legs backward and forward, and in a little while he gasped, came to, and began at once to fight us again. But by this time, his feet were tied and a rope muzzle prevented him from doing much damage with his teeth.

We got the cubs aboard the *Electra* at last, and made a roomy box for them. Then they quieted down and even lapped up milk that we gave them in a saucer. As I write this they are now probably engaged in a frolic or basking in social security at the Pittsburgh Zoo.

A SOJOURN of six months on Midway Islands, of the Hawaiian group, in 1939-40 brought me into intimate contact with some of the few remaining Hawaiian monk seals (*Monachus schauinslandi*). Today this is one of the rarest and most restricted of all the seal family.

It was probably quite abundant on the islands until early in the nineteenth century when the oil and hides became exploited commercially. We find it recorded that in 1824 the brig *Aiona* engaged in a sealing expedition to the remote islands which resulted in a great reduction in their numbers, and a while later the seals were believed to be almost exterminated. A few years after, however, their numbers had greatly recovered, for in 1859 a Honolulu newspaper, the *Polynesian*, reported the return of the bark *Gambia* with over 1500 skins obtained on the northwestern islands.

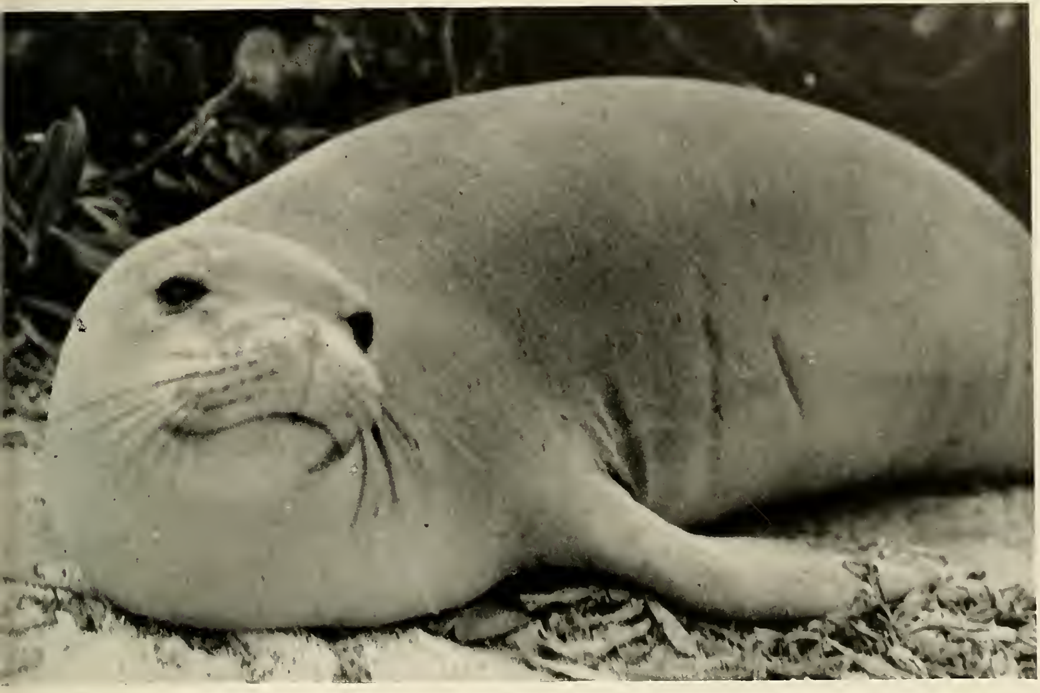
In the following years the Hawaiian seal was most likely the object of much persecution on a smaller scale. Its survival on these remote islands was probably due to a drop in the value of seal oil through the growth of the petroleum industry and to protection in more recent times by the United States Government. Since 1909 these islands (with the exception of Midway, which is under the U.S. Navy Department) have been designated the Hawaiian Bird Reservation. In spite of this protection, in 1910 the Coast Guard cutter *Thetis* found and arrested 23 Japanese who were slaughtering birds for commercial purposes.

The Hawaiian seal did not become known to scientists until 1905, when it was established as a distinct species. While it is not closely related to the seals of the Pacific mainland, it is closely related to two other species of tropical or subtropical seas. These are the West Indian monk seals, said to have come to the notice of Columbus on his voyage of 1494, and the monk seal of the Mediterranean, Black Sea, and adjacent coasts of Africa and Europe, even to Madeira and the Canary Islands. One distinguishing feature of the monk seal is that all the claws of the feet are either absent or rudimentary.

During my stay at Midway, four of the seals frequented the beaches of Eastern Island, and occasionally one or two were seen on the shore of nearby Sand Island, perhaps some of the same individuals. The Hawaiian monk seal does not migrate. Like many other seals, it probably feeds on squid as well as fish; and as both are abundant here, the ones I saw apparently make an easy living, for they spent most of the day sleeping and basking in the sun. They showed no alarm until closely approached, whereupon they shuffled off at great speed and entered the water. If cornered, they threatened the intruder, opening their mouths widely as they lurched forward and upward as if to attack, uttering an abrupt, barking noise at the same time.

RAREST SEAL

By THOMAS M. BLACKMAN



(Above) NATIVE of Midway Islands is the unique Hawaiian monk seal who has no claws and does not migrate

DISTURBED—but no longer by oil and hide exploiters. These Government protégés now bask in security

PLUNGING over a coral reef. Scars indicate that seals do not always escape injury from sharp coral

CANINE FISHERMEN

Accounts of some dogs that went a-fishing

By E. W. GUDGER

Honorary Associate in Ichthyology, The American Museum of Natural History

In 1923 I published in NATURAL HISTORY Magazine an article entitled, "Dogs as Fishermen." If one may judge by the many letters which it brought me, this gave much pleasure to many people. Some of these letters contained personal accounts of fishing by dogs and others called attention to accounts in books and journals. The information was all filed away, and further facts were added as they came to hand in the course of other studies. And now after these years it seems worth while to bring together all these interesting accounts with some photographs of dogs catching fishes into a second article, which I hope may bring pleasure to the far larger number of readers of the present-day NATURAL HISTORY.

Dogs co-operate with fishermen

Since earliest times, man's oldest friend has won admiration for his loyal spirit of co-operation in hunting, in defending his master's property, and in many other ways. The dog's skill as a fisherman is the more marvelous because he is not equipped with claws as is the cat or the bear. He has to catch the fishes in his mouth, and he probably cannot see any too well underwater. His skill as a fisherman is, therefore, another illustration of the dog's wonderful initiative and mental versatility.

The simplest form of fishing by dogs is done in co-operation with their masters—sometimes net fishermen and sometimes anglers. Some years ago William Jones recorded the following performance he witnessed by trained dogs in Wales:

> The fishermen commenced their operations at every ebbing of the tide, by stretching a seine across the river several hundred paces above the coast; and whilst drawing it towards the sea, they incessantly disturbed the water by beating the surface, as well as by hurling into it the heaviest stones they could poise. The affrighted fish made at once for the sea, which, however, they could not reach except by passing through the intervening shallows. Here they were pursued by dogs trained for the purpose, and clubbed or speared by the men. I have frequently seen from one to 200 fine fish, weighing from ten to 20 pounds each, taken in this extraordinary way.

That trained-dog helpers are not unknown in the Wales of today is attested by the next incident. In this case the dogs seemed to act more on their own initiative. This interesting personal observation is contained in a letter from Mr. Frank H. Cauty of New York City.

Mr. Cauty states that in his boyhood, at Rhos, near Colwyn Bay in North Wales, fish were caught in **V**-shaped weirs or traps. These were constructed of stones loosely piled to make long platforms, on each of which a fence was constructed of posts with intertwined willow bark. At high tide this trap was completely submerged, and during the ebb the fish were enclosed in it as the water ran out between the stones. At low neap tides the interior of the trap was practically drained and the fish were caught with landing nets.

Not so, however, if winds held the tides in, and particularly not so at low spring tides, when a pool 60 or 70 yards long and three feet deep was left at the apex of the **V**-shaped trap. Then the dogs came into play—and the fun began.

> Dogs have been used for generations to catch the larger fishes that are thus imprisoned. These fishes are usually salmon and mackerel. The dogs are very clever at their work. They constantly leap from the water with great splashes. I do not believe that this is done so much for making the splash as for the better opportunity of seeing the fish when they leap. They will chase the fishes into the shallower water, and if there are mackerel each dog will jump on one, put a foot on its head, pick it up in his mouth, lay it on the sand and go back for more.
>
> I have never seen a dog tear a fish and I was astonished on a visit in 1915 to watch the extremely accurate way in which they pin a mackerel down.
>
> With salmon their method is different. Each dog will chase one into the shallows, and when it is in fair difficulty will push it with nose or body, directing it farther ashore. They will then grasp it by the dorsal fin and carry it to the sand. As soon as the fish is landed the dog's interest appears to cease entirely. I never saw a dog watch a fish or attempt to eat it after landing it.
>
> I saw this performance frequently when a child 40 years ago, and the method was quite unchanged when I returned to Rhos in the summer of 1915. Then I saw the dogs fish probably every other day. The dogs used are retrievers, and there was an old one and a young. I was told that there was no attempt made by men to teach the young ones. The puppy is started with the old dog and soon imitates its example.

These dogs, at low spring tides, evidently did all the fish-catching, and they showed a high order of intelligence and initiative. Especially interesting is it to notice that the old dogs trained the young ones. An instance of like kind was given in my earlier article.

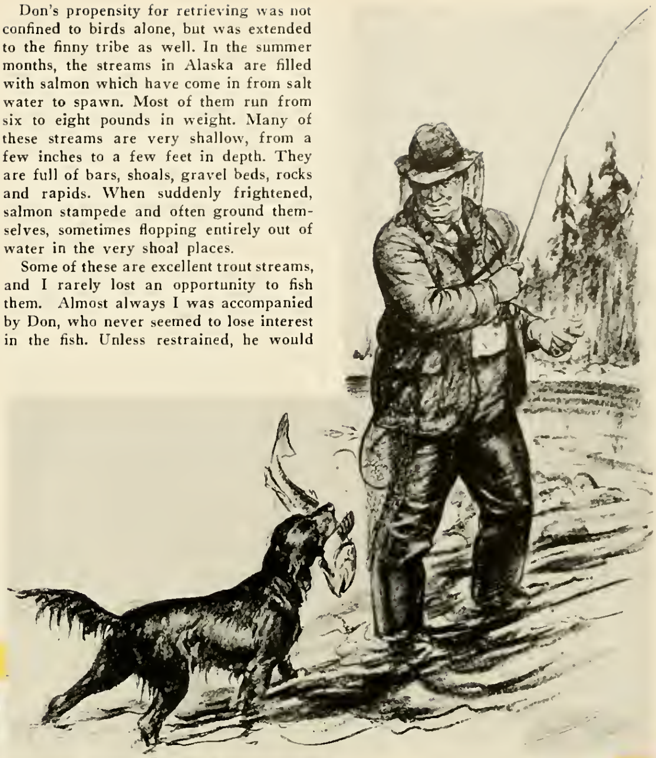
In writing of his fishing experiences in Sutherlandshire in Scotland as far back as 1849, Charles William George St. John tells of a dog who always insisted on aiding the angler in landing his catch. Here is how he did it.

> . . . Another retriever always took the most lively interest in my fishing, watching the fly and getting into a state of great excitement whenever I hooked a fish. Indeed if allowed to do so he would go in and land the fish, taking it carefully and delicately by the back in his teeth. But as he often got entangled in the line and did mischief, I was obliged to stop him. A

great treat, however, to this dog was to have some living sea trout put into any shallow pool where he could catch them and bring them one by one to whoever carried the fishing basket.

Apparently it is not at all unusual for dogs to catch fish and bring them to their masters. Here is another case —this time from Germany. Herr H. Vogler had a number of long-haired retrievers who used to fish in running water without much success. But one, on hand when a fish pond was being seined, took all the carp out of the net as it came in and carried them off. To get these he had to put his entire head underwater for each fish. This same dog used to catch fish in a deep pool in the garden and bring them "triumphantly" to his master in the house. "For this heroic deed, he openly desired praise."

Admiral Hugh Rodman, U. S. N., published an article in 1932 in which he tells how his dog, a Gordon setter named Don, would help him catch fish.



Courtesy Field & Stream

DON, a Gordon setter caught many squirming salmon whose strength sorely taxed his neck, and gave them proudly to his master

(Left) **CURLEY,** a spaniel, retrieved the fish his master hooked, in this case a four-pound pike

Acme Newspictures, Inc.

THE large dog at lower left proved himself a good fisher in a rocky cove in northwestern Mexico

Cut by courtesy Field & Stream

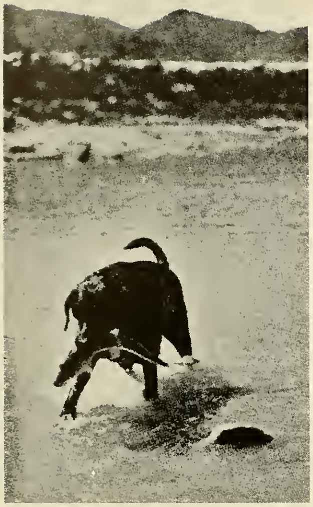
Don's propensity for retrieving was not confined to birds alone, but was extended to the finny tribe as well. In the summer months, the streams in Alaska are filled with salmon which have come in from salt water to spawn. Most of them run from six to eight pounds in weight. Many of these streams are very shallow, from a few inches to a few feet in depth. They are full of bars, shoals, gravel beds, rocks and rapids. When suddenly frightened, salmon stampede and often ground themselves, sometimes flopping entirely out of water in the very shoal places.

Some of these are excellent trout streams, and I rarely lost an opportunity to fish them. Almost always I was accompanied by Don, who never seemed to lose interest in the fish. Unless restrained, he would rush into the shallows, in the midst of a big school of fish, which would scatter in panic. Some would ground themselves and become more or less helpless.

Thereupon Don would grab one about its midship section and attempt to bring it to me. Often it looked as if Don's head would be all but twisted off by the strong muscular exertion of the salmon. Inasmuch as he seemed to enjoy it so thoroughly, and because a few fish more or less would make little or no difference among the countless thousands, I let him gratify his pleasure to a limited extent before checking him.

Accompanying this interesting article is the equally interesting picture which I am privileged to reproduce here. This shows Don triumphantly bringing a salmon to his master.

The next incident comes from a newspaper, but its accuracy is guaranteed by the accompanying spirited photograph. This shows that Bill Brokaw



THE "Labrador" at left, trained by Col. Henstock to retrieve game in India, surprised her master by voluntarily aiding him in fetching fish. When a two-and-a-half pounder was hooked in water up to her withers, she had difficulty in pushing it to the bottom to grip it with her mouth but she managed to bring it ashore

From the Field (*London*)

of Orr, Minnesota, has a real fishing dog. This spaniel, Curley by name, has been trained to retrieve the fishes his master may catch. Here he is shown bringing out a four-pound pike, hooked by his owner in Pelican Lake, Minnesota, in 1938.

In 1936, Laurence M. Huey described a most unusual occurrence at Sonoyta, Sonora, in the northern part of the Gulf of Lower California. A large school of the fish called "corbina," the Pacific counterpart of the Atlantic weakfish, rounded up a shoal of sardines, and pursued and pursuers jammed themselves into a small rock-embraced cove in which the water was only about three feet deep. All the villagers flocked to the shore, and most of the men waded in and began to throw the large fish onto shore. Thus encouraged, "A large dog proved himself to be a good fisher, and, watching his chance, would seize a fish by its back and bring it to shore, where he would bite its head until it stopped struggling, and would then dash back for another"—as may be seen in the accompanying photograph.

Here is a brief account which shows how a dog that was not trained as a fisherman rose to the occasion when called upon to aid his master.

"In 1938," writes Mr. J. Davidson, an English angler, "I caught a small fish and returned to the bank, where I banged its head on a stone, and left it, as I thought, dead. I waded back into the river, and a minute or two later heard a slight noise behind me, looked around, and saw the fish flopping about; and, as I looked, it dropped back into the water.

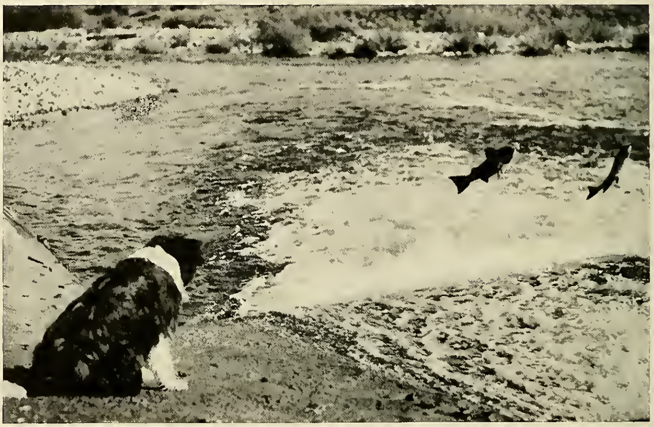
"I was too far away to do anything, so I called to my mongrel terrier, which was lying on the bank looking rather surprised at the fish returning to the river. 'Go on, fetch it, Jock,' I cried. Into the river went Jock, collected it, brought it out in his mouth, put it down on the bank, and lay down again.

". . . what struck me so curious in this instance was that the dog made no attempt to bring the fish to me, but put it back on the bank and then lay down again, as if to show that he realized that his job was done."

Mr. C. D. Earle's Sealyham terrier did, for a dog of his age, a rather unusual thing in September, 1939. This is described thus by his master:

I hooked a half-pound trout, but had no landing net with me. Having played it for some time and failed to land it, my Sealyham dog—who, incidentally, is seventeen years old—jumped into the water, which was about one foot deep. He made several attempts to get the fish, and, at the sixth, caught it. He brought it onto the bank and

The mournful collie below dreads the cold water of a stream near Selkirk, Scotland, but the sight of leaping salmon and the pangs of hunger finally cause him to try his luck at fishing



IN HE GOES "all over," emerging with his breakfast in his jaws, as illustrated below. Without waiting to dry, he eats his catch in short order

Globe Photos

gave it to me. It should be noted that this dog had never been trained to retrieve —even on land. This action was entirely of the dog's own volition.

A. Croxton Smith relates two interesting accounts of fishing dogs which he calls Labradors [i.e., presumably crosses between setters or strong spaniels and a Newfoundland]. The first dog was bred in India and taken by her master, Col. Henstock on a fishing trip to Baluchistan after mahseer—a kind of barbel. This dog had been trained to retrieve mixed game on land, but of her exploits in water Smith writes as follows:

> She had never tried her hand at fish until this particular occasion. Each time he [her master] hooked one and was playing it she whined and quivered with excitement, so that eventually, when he got on a small one in shallow water, he let her fetch it. Another time he hooked a two-and-a-half pounder in water that was up to her withers, and she had to make many attempts before she was able to push it on the bottom in order to get a grip on it with her mouth. She brought it back, dropped it hurriedly at his feet with rather an expression of disgust, and then sat down a yard or two away. She was ready for the next.

The accompanying photograph taken by Col. Henstock's native bearer, shows the dog bringing in her master's catch.

Dogs fishing for food

From serving as efficient helpers to their fishermen masters, it is not a far cry to finding dogs which fish for their daily food. As shown in my previous article, this is particularly true of dogs living in arctic and subarctic regions where their chief food is fish. But first let us go to a region nearer at hand—to Scotland. One wonders why the dogs concerned preferred the dead fishes to the live ones. In St. John's *Tour in Sutherlandshire* this interesting occurrence is noted:

> While fishing . . . one day . . . my attention was attracted to a terrier I had with me, who was busily employed in turning up stones near the water's edge, evidently in search of some sort of food. On examining his proceedings, I found that under most of the stones were a number of very small eels. When the ground was quite dry, the little fish were dead and those the dog ate; but under the wet stones they were alive and wriggled rapidly away toward the stream.

This recalls the story in my earlier article of a dog in Normandy which used to go out fishing on the sands when the tide was out. Here the beach showed scattered small mounds. To certain of these the dog would dash,

Dogs develop individual methods. A drooping tail bespeaks this short-haired dog's reluctance to venture far in the Scottish river aptly named Cauld

But when the salmon leaps near shore, the alert dog dashes in with tail waving and captures his breakfast, as shown in the photograph at bottom

Globe Photos

whine and begin to dig. Aided by the fisherwoman digging with a pickax, the dog would bring out a fat conger eel, which had hidden itself in the sand.

Augustus Grimble describes how a dog in an unnamed stream in Scotland kept fat by bringing out and eating immature salmon that had been caught higher up stream, gaffed and then thrown back into the water. Here is what Grimble writes:

> The ["colley"] dog was fat and sleek to perfection and would take a regular header when the dead fish was in deep water, and would pull it out from a depth of fully eight feet. He knew his business well and never hunted the streams, but went from eddy to eddy and searched the backwaters till he found his breakfast, and when this lay in a deep place he would often have to make many dives before it was secured.

However, there are in Scotland fishing dogs that prefer live salmon to dead ones. Furthermore, certain individual dogs have developed their own techniques for getting their breakfast—as the photographs show.

Near Selkirk the salmon, in going up stream to spawn, have to ascend some rapids. On the bank of the stream a hungry collie sits mournfully watching the fish and dreading the cold water. Finally, however, sight of the leaping fish plus the pangs of hunger overcome the dog's dread of the water. In he goes "all over," comes out dripping but with the salmon in his jaws. Without waiting to dry, his breakfast is eaten in short order.

But there are other streams in Scotland with leaping salmon in their rapids and other hungry dogs waiting on the bank. The next figure shows a short-haired dog watching for his breakfast to come closer inshore. The stream is called Cauld and that accurately describes its temperature. The dog is short-haired and the fish is far out. The dog is dejected, as the drooping tail plainly tells. However, a salmon inadvertently comes near the bank. The alert dog with waving tail dashes for it. The third picture of the trilogy shows that another shivering Scottish dog has his breakfast provided from the nearby stream.

Mr. Charles W. Townsend wrote from Boston in 1924 of his interest in my "Dogs as Fishermen" and quoted the following account recorded in his book, *Sand Dunes and Salt Marshes.* "I have seen Eskimo dogs that were kept on rocky islands on the Eastern Labrador Coast (near Battle Harbour) plunge through the icy waters for fish and spend much of their time in this pursuit." Then he adds, "I believe that they were catching cod there and that they depended on them for a livelihood as they were not fed. I have seen them on the Southern Coast catching and eating capelin."

It is well known that in Kamchatka and Siberia, the dogs which in winter are fed on dried salmon are turned loose in summer to forage for themselves. Since the streams are then filled with spawning salmon, the dogs find it easier to catch these than to hunt for prey through the woods. When Mr. George Kennan, the well-known Siberian explorer, read my earlier article, he kindly communicated some observations of his own. I quote from his letter.

> I have read with great interest your article on "Dogs as Fishermen" in NATURAL HISTORY for November-December, 1923, and I wish to add another case to those you have cited. In my early manhood I spent three years in Northeastern Siberia and two summers at Gizhiga on the coast of the Okhotsk Sea. I have many times seen our sledge dogs wade out belly-deep into the water of the Gizhiga River when salmon were running up in the summer, watch until a fish of suitable size came along and then seize it under the water and gallop ashore with it. These dogs were only long domesticated wolves, and their ancestors may have had this habit in a wild state.

Let us now go to the sunny south—to the Gulf of Mexico, to Sanibel Island, Florida, in the latitude of Fort Myers and Lake Okeechobee. On this island, Mrs. L. M. Perry has for a score of years had a winter home, and her front yard extends down to the water's edge. This in former days was very much to the advantage of Dom, her black Scottie. For when he felt the pangs of hunger, he used to take prompt action to relieve those pangs. Of his former exploits, his mistress wrote me in December, 1940.

> Poor old Dom is past the days when it was sport to catch fishes and to joust with crabs, and he is disillusioned even with mice. But in his heyday it was a regular pastime with him to go down at high tide for his ration of fresh fish. He knew perfectly well the state of the tide when schools of little fish would be swimming along close inshore, and he would wade back and forth along the shallows snapping up mouthfuls of small fish and eating them with evident relish. I never saw him catch any that he did not eat, and it seemed perfectly evident that the whole thing was to him much like fishing—both for food and fun—is for a fisherman.
>
> He did this for many successive seasons and he did not always wait for me to go out with him. I've seen him go out to the beach alone and wade after his treat. No one taught him to fish. He took it up entirely of himself. It is too bad that he can no longer keep it up. Unfortunately I never took any photographs of any of Dom's fishing exploits.

Dogs fishing for sport

In 1923 I recounted a number of instances wherein dogs seemed to fish simply and entirely for sport. Some of the accounts in the preceding section of this article have been hard to classify. They might have been included in this section. At any rate they surely contained much of the idea that the dogs greatly enjoyed the catching.

T. E. Donne in a chapter on "Poaching and Poachers" in his interesting and informative book, *Rod Fishing in New Zealand Waters,* relates the following account of a poaching dog. Apparently the dog caught the fish for fun rather than for food.

> One evening I was kneeling in brushwood and fishing at the top of a river pool, when I saw a black retriever dog creeping through some fairly high vegetation on the opposite side of the river. He crept forward slowly, looking down into the water. I remained quiet. The dog came gradually to the edge of the bank and crouched there quite still; after several minutes had elapsed he sprang right under the water and swam downstream, along the bank, coming to the surface some fifteen feet from where he dived; he had a trout of two and one-half to three pounds in his mouth. At once I bombarded him with stones, but he stuck to the trout and swam to the tail end of the pool, scrambled up a low bank, made off along an old watercourse and was soon hidden from my view in long grass.

On mentioning to Mr. George Goodwin, of the Department of Mammalogy in the American Museum, that I was at work on this article, he related to me the following personal observation of a fishing dog.

> In England, many years ago, most of the fields used to have what was known as a "marl pit." It was an old-time custom to spread the marl on the land to raise grain crops. For years, these pits have been full of water and at some early date were stocked with golden carp. During the summer months the water in the pits often became low.
>
> When I was a boy living in England, I had a fox terrier that would actually go fishing and successfully retrieve fish from these pits when the water was not too high. He would wade in and watch for a movement among the weeds and then his head would go under the water and he would snap in several directions—sometimes without success. Returning to a higher point of vantage he would watch and frequently would give the weeds a tap with his paw in order to get the fish to move. When he got a fish it was deposited at my feet unharmed. The fish was then trans-

BOY, a blooded pointer, graduated from pointing birds to doing the same for fishes. In the clear water in front of the Indiana cottage where he lived, he took the initiative to develop a skill that would put any Izaak Walton to shame

> ferred to a large stone tank of cool running spring water to harden and freshen the meat and make it eatable.

Our next account is from the magazine *Field* (London), but the reference has unfortunately been lost. George Beveridge quotes from the letter of a correspondent in Ross-shire, Scotland, as follows: "I have a dog which actually took out of a burn a sea-trout of about six pounds—surely a record for a collie dog. He saw the trout and chased it, lost it once but got it the second time."

In 1924 Prof. Ben F. Howell of Princeton University kindly wrote me of his pleasure in reading my 1923 article, and communicated a very detailed and most interesting account of the fishing habits of a dog that he had owned when a boy.

> The dog was a half-breed pointer, one of the most intelligent animals I have ever known. He had been trained to point and retrieve, but had not, so far as I know, ever been taught by anyone to fish. I raised him from a pup, and he was the constant companion of my boyhood, always accompanying me and the other boys of my neighborhood on our daily visits to the "old swimming hole" in the summer. Just upstream from the swimming hole the brook was shallow (about a foot or eighteen inches deep), with a clean sand bottom. Minnows and other small fish an inch or two in length were always to be found in this shallow water when the swimming hole was occupied by the boys; and, while we boys disported ourselves in the hole, Don, the dog, amused himself by trying to catch the fish in the shallow. He would stand in the water (which reached part way up the sides of his body) and would watch the fish intently until one of them swam near enough so that he could reach it, when he would plunge his head into the water after it, or sometimes jump after it. I never saw him catch a fish, but, since he continued for years to fish in this way, I presume he must have captured one often enough to keep up his interest in the sport.
>
> I think he must have taken up fishing as a pleasant means of passing away the time while we boys were swimming. He was fond of the water when a puppy, and probably first noticed the fish while wading about in the shallow water one day, when, having nothing else to interest him, he tried catching them, finding the sport so to his taste that he continued it. He very obviously enjoyed it, and would often indulge in it for a half hour or more at a time. Possibly one of the attractions was that the water kept him cool in the hot afternoons.

In April, 1927, my brother, David Gudger, wrote me of a fishing dog belonging to Dr. Henry Norris, who lived about three miles out of Georgetown, South Carolina.

> I have found you a fishing dog, an Irish spaniel that tries to catch fish out of the basin of a fountain in his master's garden. I saw this dog stand on the rim of the basin intently watching something in the basin and then plunge in head first. Doctor Norris said that he was always trying to catch the perch therein, and that he had already caught the slower fish. The dog always wanted to go fishing with Doctor Norris and his friends, and when a fish was landed he would grab and shake it.

I have previously given an account of the exploits of a dog in Newfoundland, who on his own initiative and opportunity and for "his own amusement" used to fish for sculpins from jutting stones. The fish were all carried to one place and laid in a pile. A. Croxton Smith (elsewhere herein quoted) relates a closely similar story of another dog in Newfoundland.

> This dog, who was entirely black, with the exception of one white foot, used to keep his master's household well supplied with fish, doing it in this way. For hours together he would remain immovable on a small rock which projected into a stream (which was filled with fish to an extent one could scarcely believe), keeping his white foot hanging over the ledge as a lure to the fish. He remained so stationary that it acted as a very attractive bait; and whenever curiosity or hunger tempted any unwary fish to approach too close, the dog plunged in, seized his victim and carried him off to the foot of a neighboring tree; and on a successful day he would catch a great number.

WIND destroyed visibility, so he never went down to fish when it was blowing. Rising from a nap, he would gauge the sun's position (direct rays were better) and repair to his favorite hole. If no fish appeared, he would "pick up his can of worms" and move elsewhere. His batting average was high

Photos by courtesy of Mr. E. H. Scott

This last account, from General Hutchinson's book *Dog Breaking,* may be of the same dog described in J. B. Juke's *Excursions in and about Newfoundland . . . 1839 and 1840.* But I judge that the two stories are of different incidents, since the first deals with sculpins (an inedible fish) and the second with fish used as food.

Remarkable in this account are the initiative and patience of the dog, his using his white foot as a lure, his catching the fish and piling them together in one place. Evidently all the dog's activities were motivated by a purely sporting impulse—which yielded his master, however, many palatable fishes. This is quite the best dog-fisherman story yet related, but a better one is to follow.

In 1929, Mr. E. H. Scott of Richmond, Indiana, came into possession of a blooded pointer puppy named Tamarack Boy, "Boy" for short. This dog presently graduated from pointing birds to doing the same for fishes. For an interesting recital of these fish activities of Boy and of how he taught himself to catch fish, I am indebted to the kindness of Mr. Scott.

A summer season was spent at Lake George, Indiana, where, strangely enough for a short-haired dog, Boy liked the water and thoroughly enjoyed riding in the boat. Standing on the bow, he would strike a pointing posture and ride across the lake, maintaining the intenseness of his point until we pulled up at the dock, unless a quick side motion of the boat pitched him into the water. But such a mishap had no lasting effect on his desire to go or on his riding position.

When in the boat, Boy would insist on picking up every dead fish he could see floating in the water, also on personally inspecting each fish taken off the hook before it was released or placed on the stringer. He had that persuasive way that would cause you to pull the boat out of its course so he could pick up a fish slightly out of his reach. Apparently asleep in the front end of the boat, he seemed to know when a fish was being landed. If my back was to him, as it frequently was, he would place his nose under my elbow, and with a quick twist raise my arm. He seemed to say: "Let me see that one." Just a sniff at the flopping fish was all he wanted, and he would go back and lie down, only to return again on the next take. During the week, when there was no one to go fishing with him he would look out across the water with an expression of longing equal to that of any veteran fisherman at a lake without tackle.

Just in front of our cottage the water was shallow and clear. Sunfish and bluegills would spawn in the early season. From a point of vantage on the boat landing, Boy would, on clear days, watch them fanning over their nests. The sight of these pan fish, and my absence, no doubt prompted him to go fishing alone. How long he was in thinking it through, I do not know, but much to my surprise I found him one day enjoying his and my favorite sport unassisted.

For six years he fished at Lake George. His technique improved as his experience increased. He soon learned that a slight ripple on the water destroyed the visibility. So when the wind was blowing at all, Boy did not go fishing. Next, he seemed to learn that the more direct the rays of the sun, the better he could see—and he confined his fishing to mid-day hours.

I have seen Boy wake up from his noonday nap—stretch himself—look up at the sky as if to locate the position of the sun—then walk directly to the water and without a moment's hesitation go out to his favorite spot and start fishing. He would stand as immovable as any pointer you ever saw with quail under his nose. With eyes glued to the water, he would wait and wait. If no fish appeared, he would very quietly move to a new spot, and do it just as deliberately as you ever saw a man pick up his pole and his can of worms and go downstream to the next fishing hole.

The patience of Boy's immediate ancestors in hunting quail in a country where few quail were to be found could be seen in his long waits for fish that did not always appear, and his lack of disappointment in those that got away. With a batting average that would not approach what would be called good in the major league, he never lost his enthusiasm or the love of the sport, but he did show much improvement as the years went by.

How did he do it? Frankly, I do not know, but I have stood on the sea wall overlooking the water and watched fish of various sizes and kinds swim between his legs and all around him. I have seen them nip at his legs and dart away, as though they were playing a game and getting a lot of fun out of it. Perhaps the explanation is that fish are attracted by hair—hence the buck tail bait. . . . If the fish are attracted by waving hair on the dog's legs, they may follow it upward sufficiently close to the surface and give him an opportunity to catch them. At any rate I have seen Boy slowly lift his foot before attempting to catch them. Like a good fisherman, he brings his fish still alive to the house with just as much pride as a barefoot boy would show on a similar occasion.

All of which causes me to wonder whether a little encouragement is not all that is needed for many a dog to develop an unexpected sport, which will prove as entertaining to the master as to the dog himself.

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GEM FOR

Whoever wears the traditional bloodstone may claim its legendary powers, even over the wrath of kings and despots

IN the Middle Ages, when the art of gem engraving was little understood, images found upon stones were thought by many to be the work of nature or of some mysterious power, rather than the craftsmanship of man. They were valued accordingly. For a stone which today could be bought for very little, an Elector of Mainz offered the district of Amöneberg—and was refused.

The gem for March, according to general tradition, has been the bloodstone, or jasper; and this stone comes down to us with its share of supernatural lore. Legend has it that the drops of blood caused by the spear-thrust in Christ's side fell upon a green stone at the foot of the Cross to make the first bloodstone. One can imagine, therefore, that a stone showing Christ's head with blood spots on the features, looking for all the world as if they had fallen from the wreath of thorns about His head, would be regarded as holy, and it would be highly valued, and that it would be worn with superstitious awe.

One of the oldest legends of the bloodstone is responsible for the name "heliotrope" by which this gem is sometimes known. According to this story, a bloodstone placed in a bowl of water tinged the water red; and the reflection of the sun, seen in the bowl, also became red. Hence the nickname heliotrope, which means "sun turning." Prophets playing upon the superstitions of the people and their lack of curiosity for scientific fact, extended the magic of this stone still further, claiming that it had an actual power over the sun itself and could cause storms and tempests. By waiting until bad weather approached, they claimed to bring on storms and then professed to interpret future events as "told" to them by the howling winds—prognostications possible, of course, only to the supernaturally endowed.

Bloodstone is a variety of quartz, of which the amethyst is another variety.* Quartz is one of the common minerals, and since it is hard and comes in many colors it is inevitable that it should find wide use as a gem. Chalcedony (of which bloodstone is a variety) and jasper are finely crystalline varieties. In place of the

MARCH

By FREDERICK H. POUGH

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Bloodstone figurines from China

large single crystals from which a transparent amethyst gem is cut, we have here a compact, opaque mass of many microscopically intergrown crystals. And whereas transparent gems are faceted, chalcedony is cut in rounded form. Bloodstone is a deep green from chlorite inclusions, and red spots are from iron oxide. Some gems show little red, others have abundant flecks.

The highly valued variety of chalcedony known as bloodstone was thought to be one of the most efficacious stones in the cure of bleeding. An interesting old book of 1483, *Hortus Sanitatis* by Johannis de Cuba, depicts what must have been, for that day, a scientific test of the value of the bloodstone in halting a nosebleed. Other myths attribute additional powers: the wearer will get whatever he asks for, he will be able to calm the wrath of kings and despots, and his statements will always be believed. (Perhaps some politicians use this gem today!) Other powers enable the owner of a bloodstone to open any door, burst bonds asunder, and level stone walls—by merely speaking the name engraved on it.

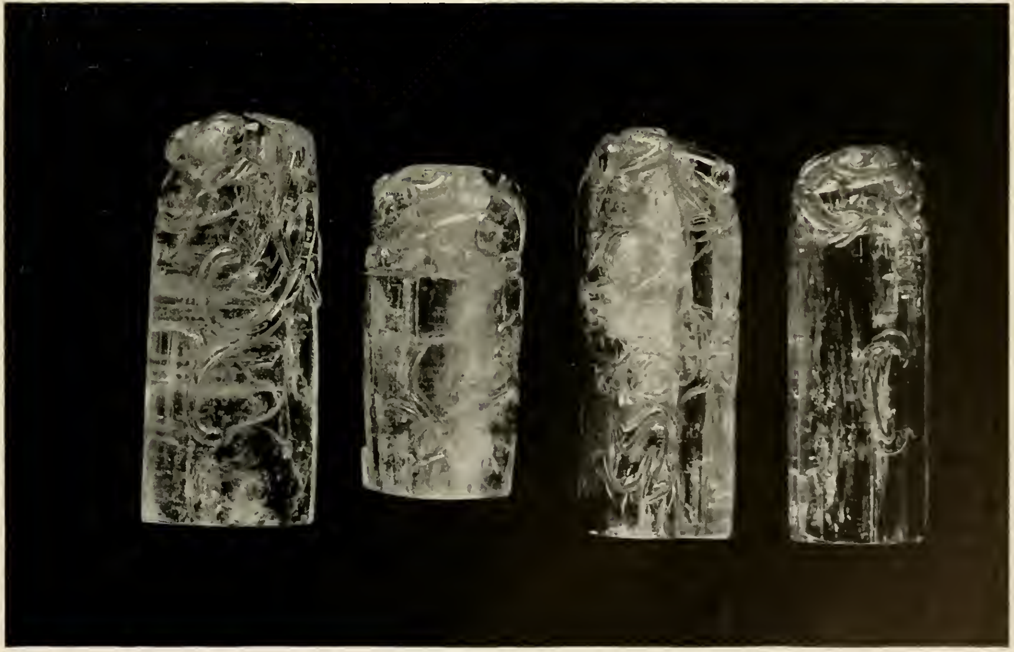
Today bloodstone is one of the commonest of gems and one of the least expensive. Most of the rough material comes from India, where it occurs with agate, carnelian, and chalcedony. However, there are many other sources—Brazil, Australia, and several places in the United States. The best stones are those in which the red flecks are not large but are fairly widely and uniformly distributed over the surface.

Jewelers have officially adopted an alternative stone for March, the aquamarine. Though lacking the justification of tradition, this gem is one of the most attractive of all the less valuable gems (the term "semi-precious" is no longer approved by jewelers). The aquamarine derives its name from its resemblance to the color of sea water; and individual stones vary, just as the sea does, from deep blue to pale blue-green. The most desirable are the deepest blues, which are available in considerable quantities, from Brazilian deposits. It has recently been discovered that a moderate heating renders the greenish stones bluer, presumably by driving off some of the yellow. Aquamarines have been found on every continent, and among the more important American localities are Maine, Massachusetts, Connecticut, North Carolina, Colorado, and California. The deeper shades, however, are rare.

Aquamarines were perhaps the original ouija boards. In the Middle Ages a beryl-set ring was suspended in a bowl of water, the edges of which were marked with the letters of the alphabet. Answers to questions were spelled out by the aquamarine as it stopped before successive letters. A man who held an aquamarine in his mouth could, it was thought, call the devil out of hell and force him to answer questions. Today, fortunately, we are more interested in the beauty than the utility of our birthstones.

Chinese seals carved from aquamarine, the alternative stone for March

All photos AMNH by Kirschner



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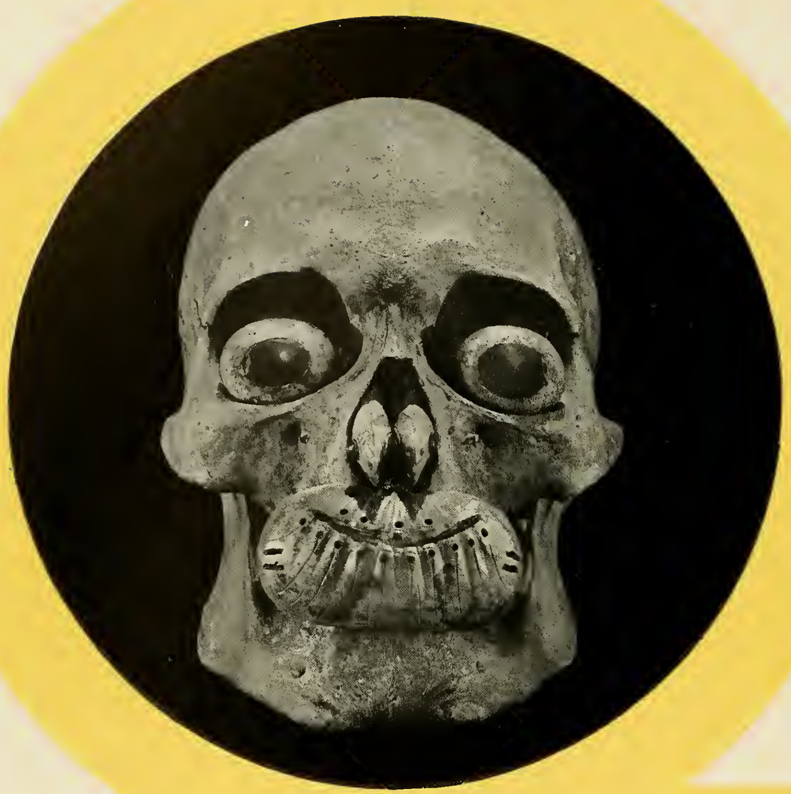
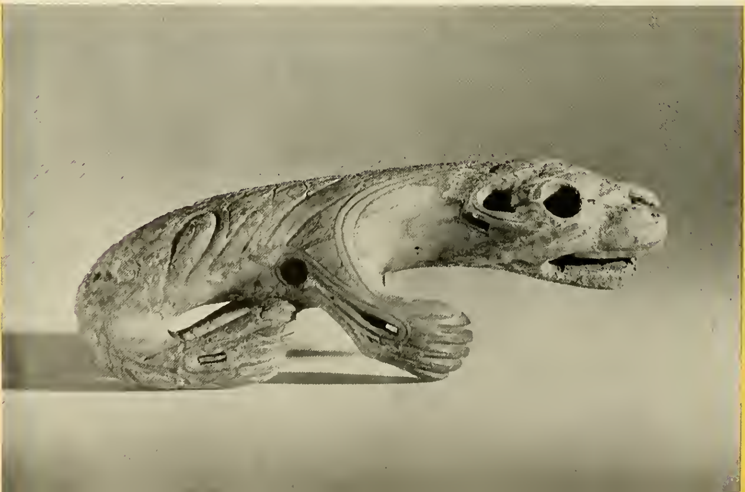
*See "Gem for February," by Frederick H. Pough, NATURAL HISTORY, February, 1941, p. 73.



MYSTERY PEOPLE OF THE ARCTIC



(Circle above) THE IVORY EYES of this skull from northwest Alaska look out across the centuries from an age when the glories of ancient Mexico were probably not yet born in human thought. With its inlaid pupils of jet, its ivory nose plugs, finely carved to represent birds' heads, and its ivory mouth cover, this guardian spirit of the buried city of Ipiutak left even the modern Eskimos speechless. The lip design suggests that the people may have had the idea of sewing the mouth shut to prevent the escape of the spirit

(Left) AN IVORY SEAL, carved by the "Mystery People." The size of their ancient settlement on Point Hope amazes modern investigators

Excavation of an "Arctic metropolis" on the ancient migration route from Asia to America reveals a previously unknown culture on the northern fringe of our continent, probably older than the Aztec and Maya civilizations

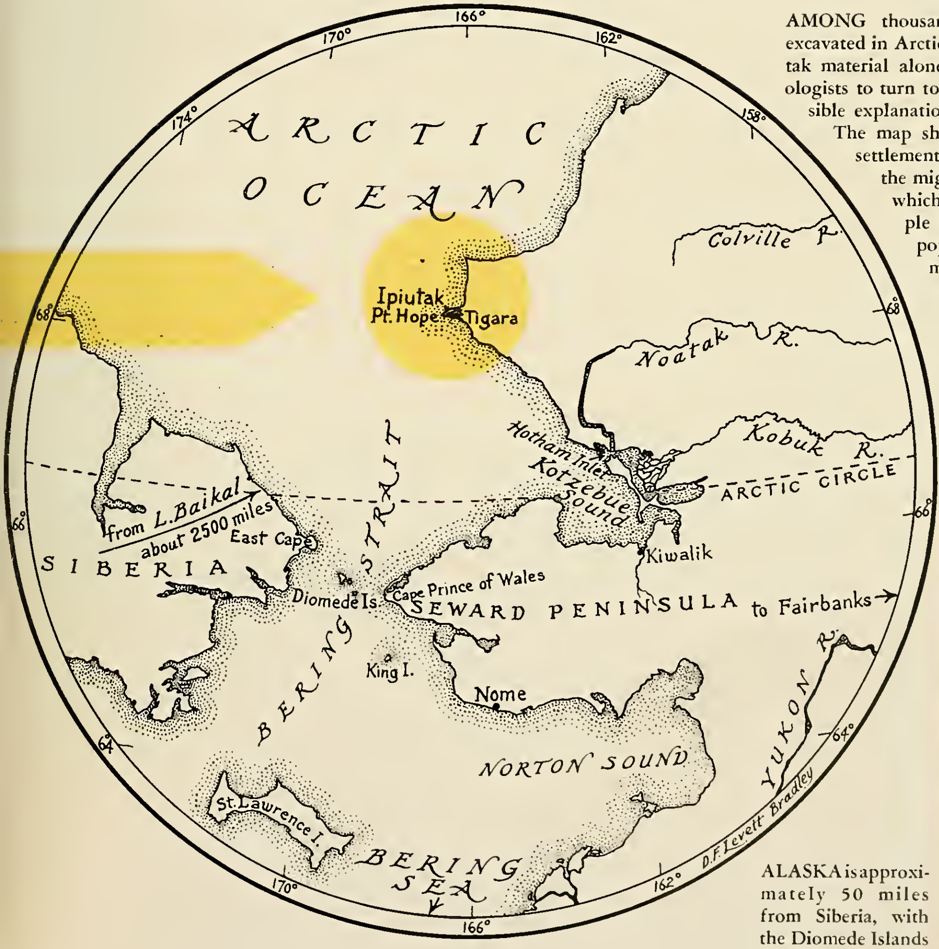
By FROELICH G. RAINEY

Professor of Anthropology, University of Alaska

MYSTERIES of all sorts have come out of the Arctic to stir the romantic interest of the civilized world—mysteries of lost expeditions and of lands that had been reported only to vanish. But the most fascinating mystery of all lies back of the people who live along this outermost edge of the habitable world.

The corner of Alaska nearest to Siberia is a key point in the search into the past, not only of the Arctic itself but of prehistoric America as a whole, because it is probably the region where primitive man first entered the Western Hemisphere. Today this "oldest" part of America is occupied by only a scattered population of Eskimos. Much digging has been done in prehistoric village sites, and the quantity of human relics unearthed is large. All of the material, however, has differed only in degree from the implements used by present-day Eskimos, with the single exception of the extraordinary discoveries I am going to describe. We have now found an "Arctic metropolis," many times larger than anything previously thought possible in this part of the world and inhabited by people whose material culture differed markedly from that of the Eskimos as we know them.

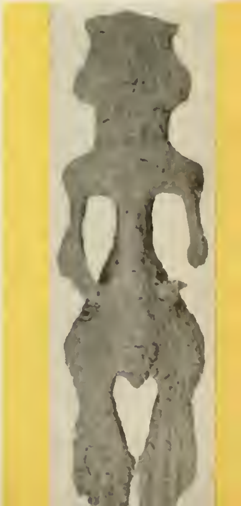
The discoveries which promise to tell the story of a new episode in man's history in the Arctic were found during the last two years at a point 200 miles north of Bering Strait. The ancient settlement is located upon a sand bar 20 miles from the mainland, where there is no fuel, not a single tree and hardly any vegetation of any kind, and where gales blow for weeks with the temperature at 30° below zero. Whereas settlements of no more than 250 Eskimos can barely find enough food to survive the winter in


166°
170°
162°
174°
158°
ARCTIC OCEAN
Colville R.
Ipiutak
Pt. Hope
Tigara
68°
68°
Noatak R.
Hotham Inlet
Kotzebue Sound
Kobuk R.
ARCTIC CIRCLE
66°
66°
from L. Baikal
about 2500 miles
East Cape
SIBERIA
STRAIT
Kiwalik
Cape Prince of Wales
Diomede Is.
SEWARD PENINSULA
to Fairbanks
BERING
King I.
Nome
YUKON R.
64°
64°
NORTON SOUND
St. Lawrence I.
BERING SEA
170°
162°
166°
D.F. Levett Bradley

AMONG thousands of objects excavated in Arctic America, Ipiutak material alone forces archaeologists to turn to Asia for a possible explanation of its origin. The map shows the buried settlement just north of the migration route by which the Asiatic people who originally populated America may have crossed

ALASKA is approximately 50 miles from Siberia, with the Diomede Islands as steppingstones

A DOLL or fetish found among the ruins



this region today, this colony probably numbered several thousand persons and was apparently maintained successfully for many years. Then its inhabitants disappeared.

Thouands of implements were found in the house ruins and graves of a large cemetery nearby. Yet the one implement upon which the inhabitants of this region have had to depend absolutely for food—the harpoon for catching sea animals—is rare. The bones of the animals are there, but nothing that clearly explains how they were caught. The fantastic ivory carvings found in the houses and graves are unique. While the workmanship is by no means primitive, it must precede other known Eskimo cultures on the Arctic coast. Certain features suggest a connection between the style of this art and that of the earliest Eskimo cultures, but the ivory carvings and the beautifully chipped flint implements suggest a relation between these people and eastern Asiatics.

How was it possible for such a large group of people to maintain themselves on the barren Arctic coast? Where did they come from and where did they go? Were they the ancestors of the Eskimos? These are a few of the questions we have attempted to answer since we and our Eskimo diggers uncovered this new riddle of the Arctic.

The story of how we found the ancient metropolis will give you some impression of the land as it is today. The Arctic explorer Knud Rasmussen had described the remains of a different settlement adjoining the Eskimo village of Tigara on the Point Hope sand spit as the largest ruin in the Arctic. In the spring of 1939 Helge Larsen, anthropologist at the Danish National Museum, joined forces with Louis Giddings and myself from the University of Alaska and the American Museum of Natural History to excavate that site. We arrived by airplane before the pack ice had retreated toward the north; and as we flew out along the Point Hope bar, the narrow ribbon of sand below us resembled a gigantic breakwater reaching out into the Arctic Ocean. The western extremity was a green spearhead thrust into the broken ice field.

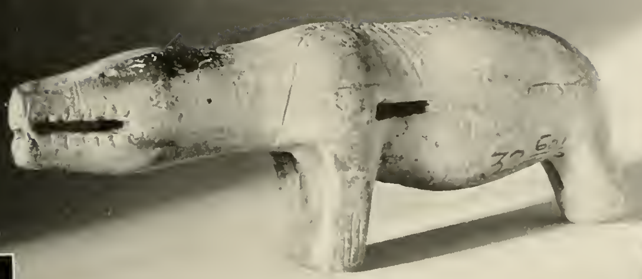
It was here that we found the Tigara Eskimos, popping up out of their semi-underground houses as we circled the village. From the air the present village seemed a continuation of the ruined village.

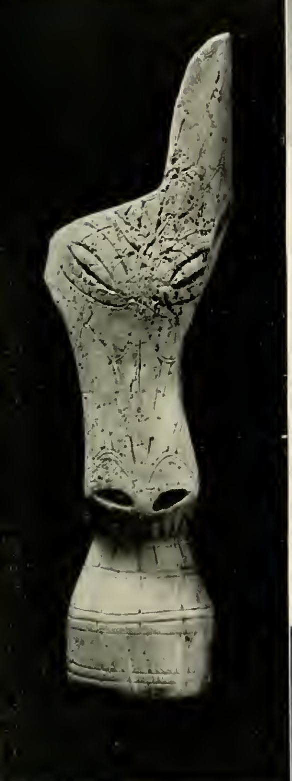
Our excavation disclosed that the site had undoubtedly been occupied for many centuries by Eskimos very much like the present inhabitants. The popularity of that spot is due largely to the fact that bowhead whales pass the point in the spring on their yearly migration north and east into the Arctic Ocean. These great baleen whales were and still are one of the chief food sources of the Eskimos, who not only store tons of whale meat in underground caches but use the baleen, or whalebone, and the bone as raw material for implements and utensils. The jawbones are even used for house beams and as markers in the recent cemetery. Hair seals, bearded seals, walrus, and white whale (beluga) are also harpooned in considerable numbers, particularly in late spring. Before the domesticated reindeer was imported from Siberia, the Tigara settlement was abandoned each summer while families spread out in the highlands of the interior to hunt caribou, mainly for the skins, which were needed for winter clothing. Caribou meat, apparently, was never an important part of their diet, and even today reindeer meat is of little consequence. Literally millions of sea birds nest on the high rock cliffs of the mainland, where they and their eggs are taken for the summer food supply. But in spite of all this, the food resources of the region have never supported a settlement remotely approaching the size of the one we were about to discover.

Eskimos living on about the same scale as the modern inhabitants can be assumed, on a basis of considerable excavation, to have dwelled in northern Alaska for perhaps 2000 years; and at the Tigara site we found nothing surprising. Farther east on the Point Hope bar we found other ruined settlements, but these also, although somewhat more ancient than the main one, contained implements of the familiar Eskimo type.

Then one evening Larsen and Giddings noticed some faint, rectangular impressions along the north shore of the bar, northeast of Tigara, at a place known to the Eskimos as "Ipiutak." Many years ago an Eskimo had found some stone and ivory implements at the site, but no one realized that the ruins of a large town lay underground. In the summer of 1939 we excavated a few houses here and found implements unlike anything we had seen, but even then the size and significance of the settlement were not anticipated.

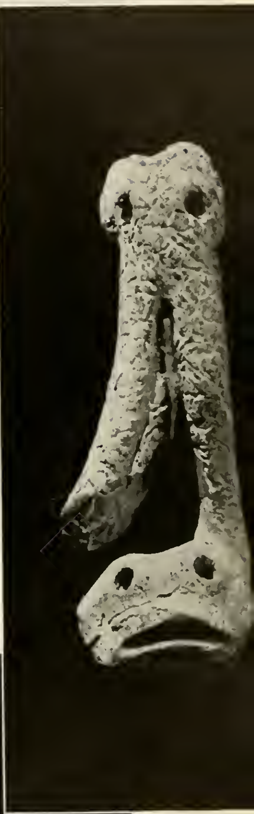
One morning in June, 1940, when Magnus Marks and I returned to begin the second season of digging at Ipiutak, we became aware of the astonishing extent of the ruins—and through a peculiar circumstance. At that time of the year the grass and moss on the bar were just beginning to turn green. Owing possibly to the fertility action of the refuse beneath, the growth over the house ruins was slightly taller than on the surrounding plain, and consequently it retained the yellow cast of dead grass for a few days longer than that on most of the bar. Thus we could see long avenues of yellow squares, marking the house sites, extending east and west along the north shore. Within the next few days we hurriedly charted the location of the yellow squares and found that there



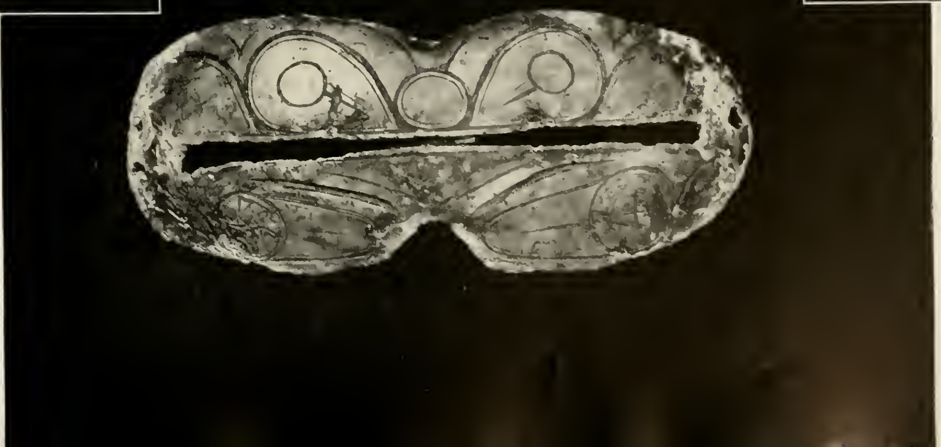


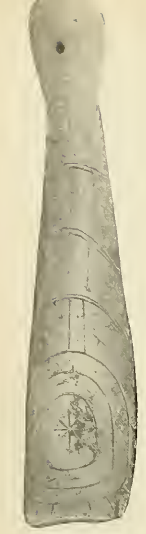
SOME objects left by the Ipiutak people do not differ markedly from recent Eskimo art, as is the case with the ivory bear above, of which comparable examples are found in various parts of Alaska

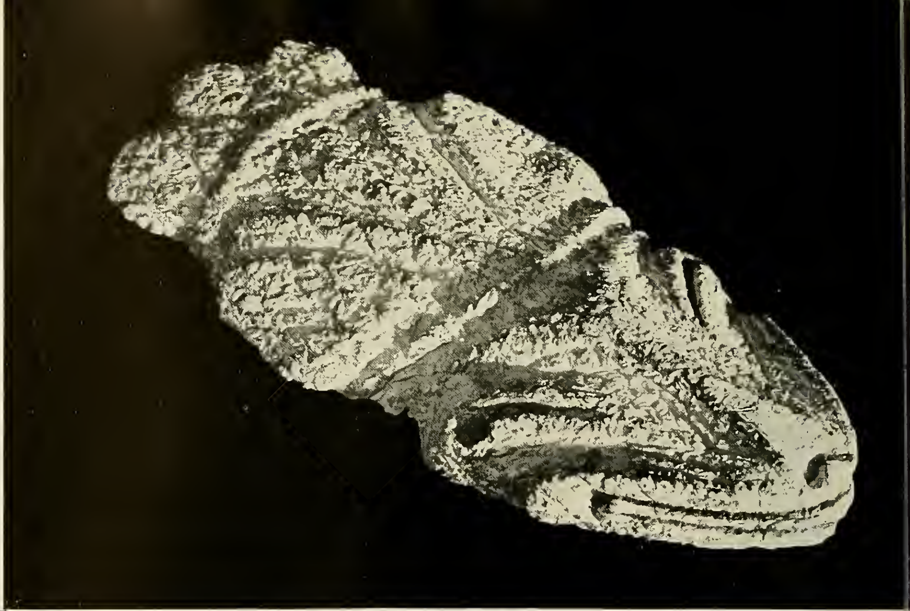
THE ARTICLES at left and right, however, are difficult to name and their utility remains a mystery. The likeness of an animal's head has been carved on each. The random lines marring the surface, particularly of the piece at right, are apparently the result of erosion by roots in contact with the ivory for centuries

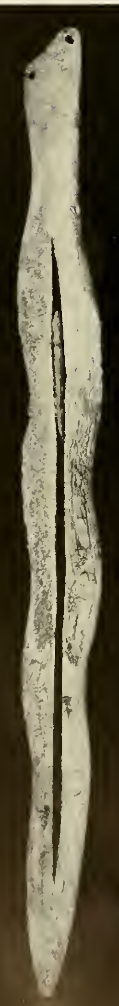


SNOW GOGGLES to protect the eyes from snow blindness have been manufactured widely by the Eskimos for centuries, and the example below is more or less typical, except for the distinctive design cut on the surface. When worn in the dazzling sunlight, the slits effectively reduce the amount of light which reaches the eyes







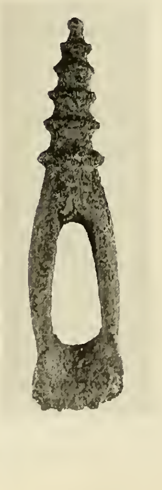


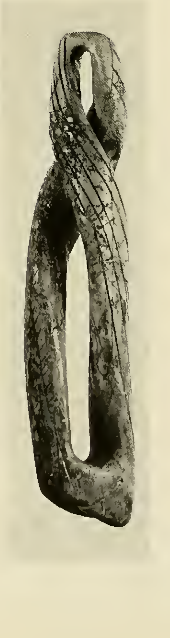
IN SIZE AND SHAPE the object at upper left is like a modern shoehorn. It may be a wrist-guard used to protect the wrist of an archer from the slap of the bowstring, but it only faintly resembles wrist-guards made by historic Eskimos. The ivory monster-like carving above has a perforated projection on the lower surface and must have been attached to some heavy object, perhaps a boat. Eskimos carve many Arctic animals such as seals, but this is not similar to any living form.

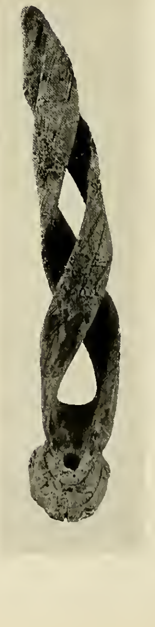
The object at extreme left shows how the Ipiutak people inserted wafer-like flint blades in their weapons. Only one blade of the original series remains in this lance head, near the upper end of the slot

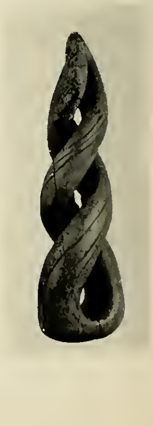
UNLIKE ANY ART PREVIOUSLY FOUND IN ARCTIC AMERICA

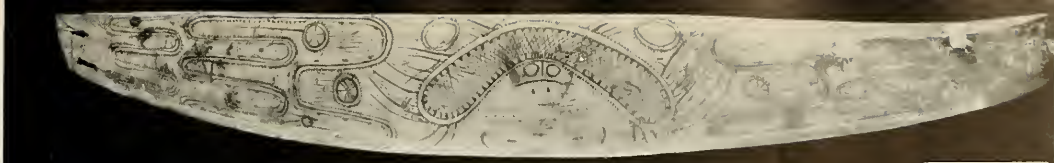
THIS peculiar double spiral motif, comparable only to certain art forms of the Ainus of Japan and the Amur tribes of northeastern Asia, suggests that the origin of the Ipiutak people may successfully be sought in Asia. The possible utility of the objects shown is not known but some resemble swivels perhaps used with dog harness







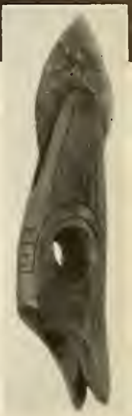


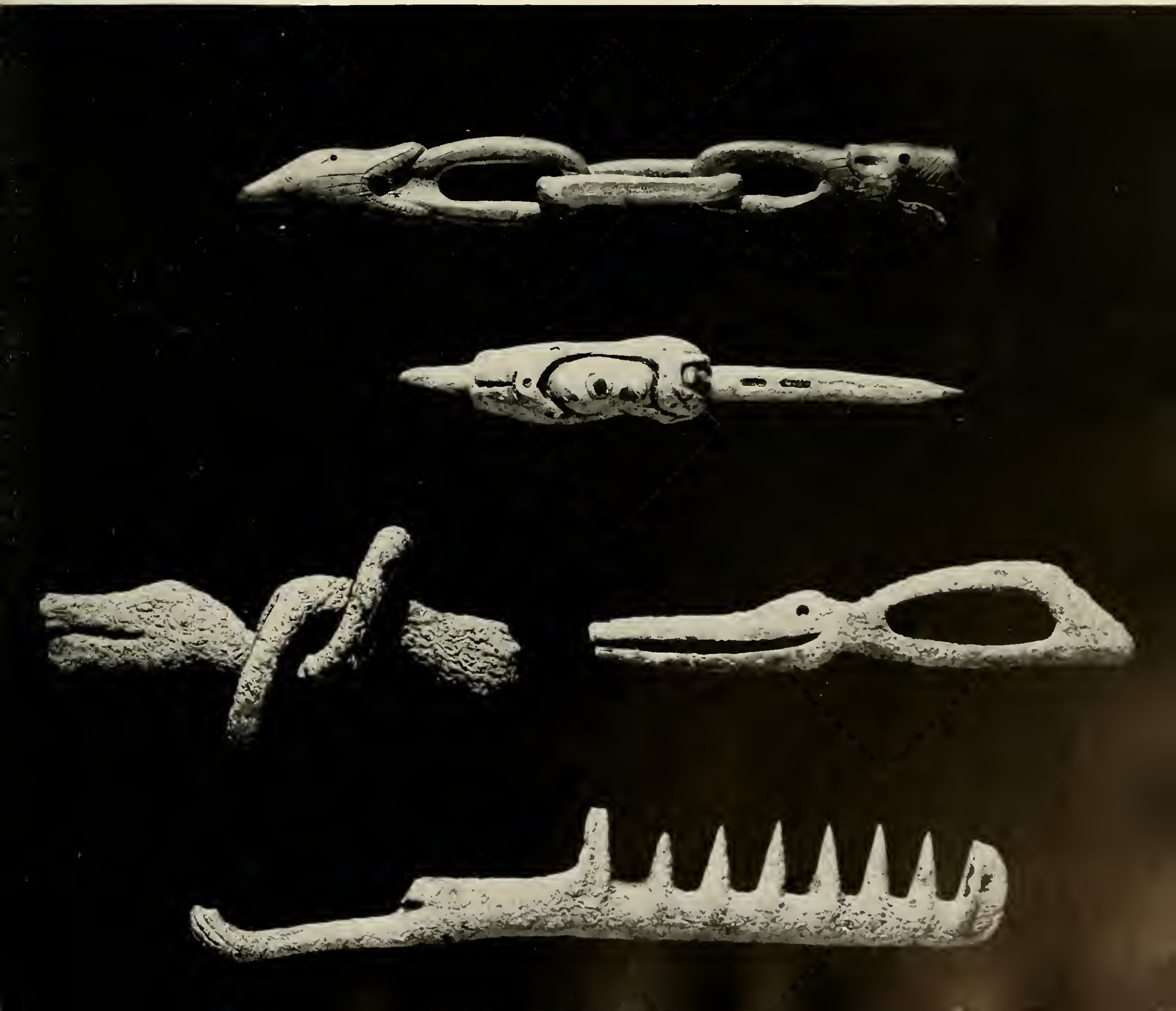


THE ELABORATE and sophisticated carving of the Ipiutak material indicates that the people of this Arctic metropolis may have been immigrants from some center of advanced culture. It also shows that, though their numbers were greater than had been supposed possible on this northern fringe of the habitable world, they had sufficient leisure for purely artistic activities

THE IVORY OBJECTS below show the bewildering variety of unidentifiable implements made by Ipiutak people and their remarkable ability in carving chain links, loops, and relief figures from solid blocks of walrus ivory. Inlaid jet eyes are typical. Heads of birds and polar bears are recognizable

HARPOON HEADS like the modern Eskimo's are rare at Ipiutak *(at right)*. The commonest weapon points are antler arrowheads with crescent-shaped flint blades set in the edges. Since Eskimos kill sea mammals with harpoons and not arrows, hunting methods of Ipiutak people must have been different





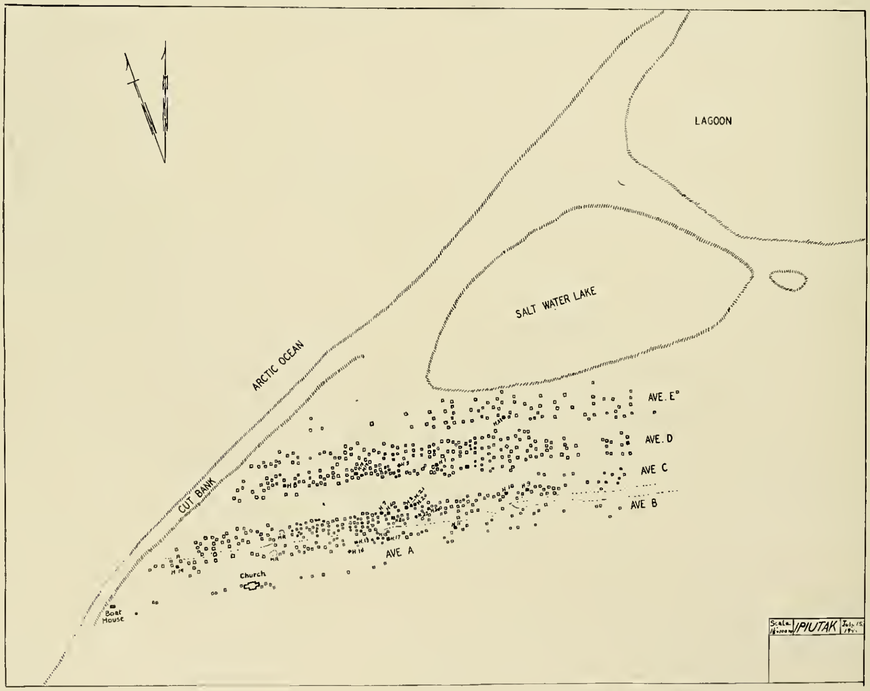
were five "avenues" lined with houses, as well as short cross-blocks of houses arranged at right angles to the thoroughfares. There were over 600 houses on the completed chart. Later numerous test pits disclosed that there are probably 200 additional houses buried beneath so much sand from the beach that they cannot be discerned on the surface. The town was nearly one mile long and a little less than a quarter of a mile wide.

The arrangement of the houses, the similarity of the implements found in all 23 houses excavated, the fact that none were superimposed over older structures, and the absence of any large refuse deposits covering any of the village, lead us to believe that the majority of the houses were actually occupied at the same time. With an average of five persons to a house, the village would have a population of 4000, a seemingly incredible number of inhabitants for a hunting village on the Arctic coast.

The design of the houses is still a matter of doubt. We know that they were square and from four and a half to five and a half yards on a side and that they had a central hearth in which driftwood and blubber were burned in an open fire. Eskimos almost universally use a stone lamp for heat and light; but not a single lamp was found in the Ipiutak village. We also know that most of the houses had a long entryway facing west, that some driftwood logs and poles were used in construction, and that some had a plank or pole flooring about the central hearth. The walls and roof may have been made of driftwood or of sod blocks, moss, or skin placed over a wooden frame-

Continued on page 170

PLAN OF THE ARCTIC METROPOLIS. Today a village of 250 Eskimos is a large one on the Arctic coast of Alaska and often has difficulty securing enough food. The buried Arctic metropolis of Ipiutak was nearly a mile long and boasted five avenues aggregating at least 600 or 800 houses. The astonishing fact is revealed that at least 4000 persons must have occupied the village, a population which can scarcely be explained on the limited resources of the site as known today

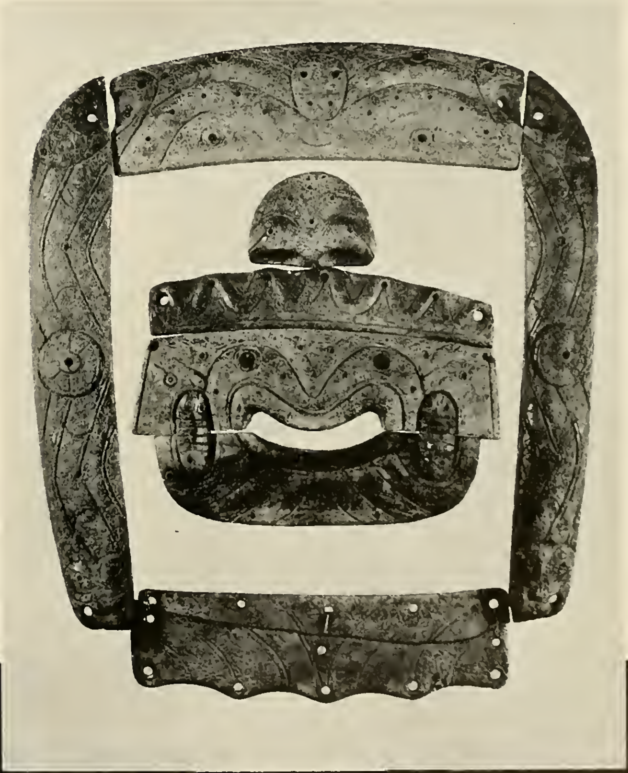


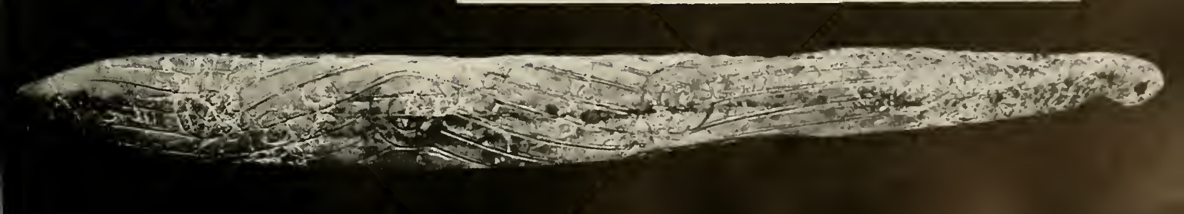
FLINT IMPLEMENTS found in the Ipiutak houses and graves number several hundred. Many are extremely small and beautifully made in a great variety of forms. Some were found set in arrowheads and knife handles but others are of unknown use. The Ipiutak flint working technique resembles that of early neolithic people in northeastern Asia and stands in sharp contrast to the cruder technique of the Eskimos. There are no rubbed slate blades but a few rubbed stone adz heads are present, which are not unlike those made by Indians

THE SET of massive ivory carvings below at right was found in graves which had been disturbed and partly destroyed by the burrowing of ground squirrels, and consequently the original arrangement of the parts is not certain. Presumably they were lashed in this form upon the cover of the log tomb or upon the breast of the body within. Jet eyes are inset, and a complex engraving covers the upper surface. Wheel-like figures and bands of parallel lines in part resemble incised figures made by the Old Bering Sea Eskimos, probably about the time of Christ

POSSIBLE LINK WITH EUROPE OR ASIA

THE IVORY OBJECT below may be a knife handle or a lance head. Along both edges are slots in which were set a series of small, crescent-shaped flint blades. Similar implements are characteristic of the Maglemosian epoch in northern Europe, and in the Eskimo region the technique of insetting a series of cutting blades has survived into recent times on Southampton Island in eastern Canada. Such implements in the collection suggest that the Ipiutak culture may be a connecting link both in time and space between Arctic culture of the Old World and the New

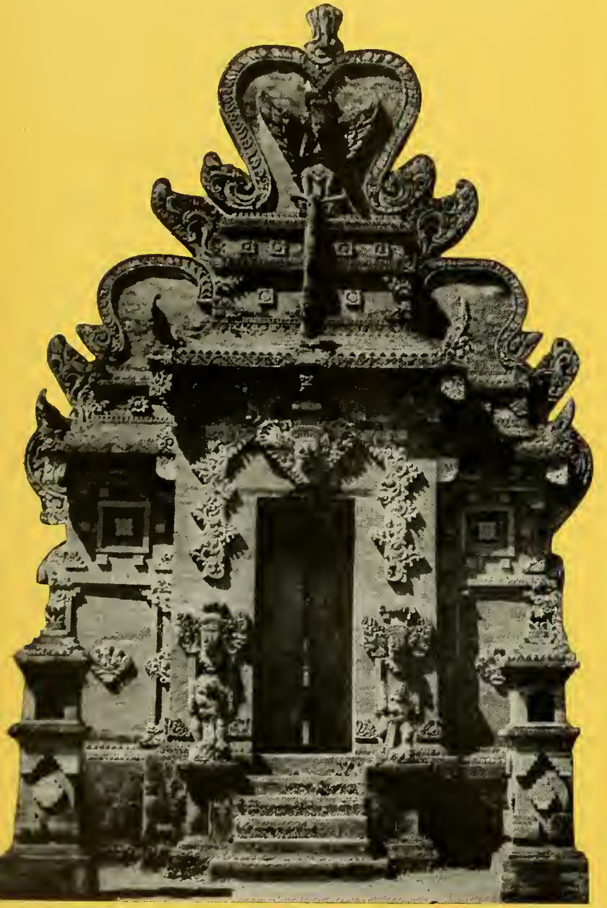




SOJOURN IN BALI

By MARTIN BIRNBAUM

In a region which may soon become a theater of war, the peaceful isle of romance still charms the world with its distinctive art, music and traditions



". . . Suddenly we turned a corner and were transported into an unbelievable world." This delicately carved doorway of a shrine standing in one of the three enclosures which constitute a "temple," illustrates the fine artistic sense of a native people who have made their island home a byword for beauty and romance

WASHED by a calm sea, Bali's rich green, mountainous shores made an immediate and glamorous appeal, but the waterfront of the town of Boeleleng was painfully ugly. As we approached the wharf in a motorboat, superbly built bathers and fishermen smiled a pleasant welcome, and I discovered a group of half-naked men playing games of chance on the smooth, black volcanic sand, ruled in squares to serve as a gaming board. Dirty looking, betel-chewing women walked up and down, carrying their possessions on their heads in old oil cans. K.P.M. agents, insistent guides, ubiquitous Chinamen, curio dealers, and greedy chauffeurs surrounded me.

My heart sank, and my spirit of romantic expectancy faded away. Disappointed but resigned, I placed myself in the care of a native driver, intending to cross the island at once to Den Pasar on the southerly coast, and I mentally decided to return quickly and catch the first available steamer for Java. I had obviously come too late to the isle of dreams which my friend, Maurice Sterne, the American painter, had visited and described to me over 20 years ago, but at least I would see a volcano or two before I sailed away with another dream shattered.

My refined chauffeur's name was Ngoman ("the third born") Gdé ("big") Mangkoe ("priest") Madé. When he was not driving a car, he acted as a provisional minor church attendant in his village or *desa,* and he took his young nephew along to assist him on our drive. Ngoman Gdé spoke and understood simple English phrases, and as we drove past commonplace villas with front garden patches like those I had seen in Java, I warned him not to stop to show me the cinema palace or the bank building. This admonition from his *toean* made him visibly more interested in my plans.

(Right) ONE of the largest arboreal wonders of the world: the banyan tree near Bongkasa, whose branches shade approximately two acres of ground. Many small temples and shrines have been built beneath this mysterious green mansion. It was under a similar tree that the altar described on the opposite page was erected, decorated with floating banners and approached by an avenue of ornamental streamers

He drove swiftly out of the town of Singaradja, away from the abodes of Dutch officials, into the heart of his island, refusing even to stop at interesting looking temples, politely explaining that they were unworthy of his employer's notice. Black pigs, resembling the Sumatra variety, with curved backs and bellies almost touching the ground, scooted out of our pathway, and venturesome hens and mangy mongrels barely escaped with their lives. Fighting cocks were secure in their bell-shaped baskets on either side of the road, and soon we were passing files of women walking like goddesses, carrying their burdens on their heads in the customary way. Men had their wares at the ends of flexible bamboo poles balanced on their shoulders. Both sexes were usually nude above the waist.

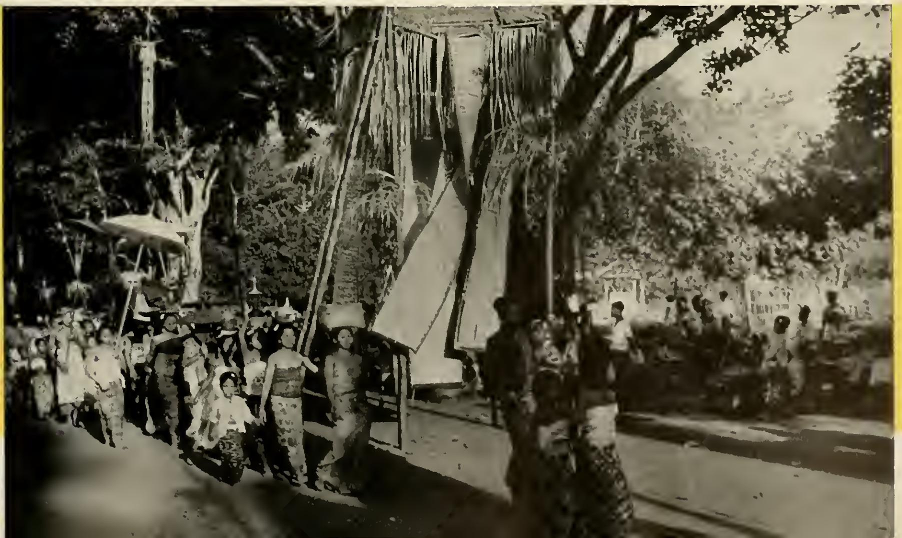
The villages along our route were surrounded by thatched walls, and the vegetation was like that of Java,—palms, bananas, crotons, thickets of bamboo, flaming cannas, many varieties of hibiscus, lantana blooming along the road with tropical negligence, frangipani, poinsettia, and vast rice *sawahs*. As we left the narrow northern plain along the coast for the hills, the landscape became more and more beautiful. The air was now refreshingly cold and bracing. We were climbing the foothills of Mount Batoer, one of the active volcanoes. Separated from us by *sawahs,* gorges, and fresh lava beds dating from a recent disastrous eruption, its smoking cone and black slopes suddenly burst into view at Kintamani, and the effect was startling.

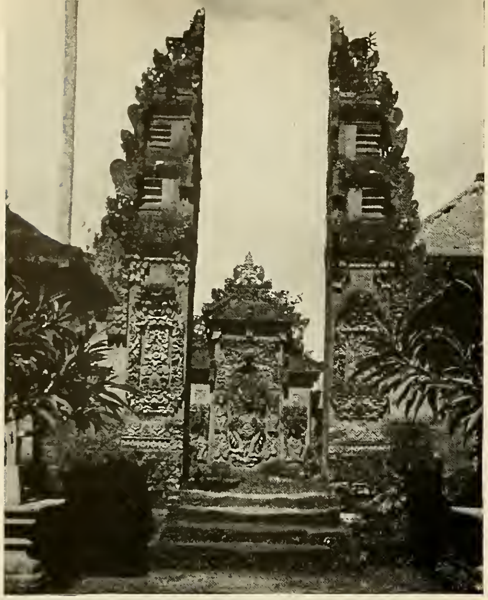
During the entire morning ride, I had been agreeably surprised to notice that only two automobiles with white men had passed us, and my hopes began to rise as we coasted south to Den Pasar, a distance of about 75 miles from Boeleleng. On arriving at the Bali Hotel, I was shown to my rooms—the usual comfortable Dutch colonial arrangement of bedroom, bath, and outdoor sitting room—, which faced a pleasant flower garden, where gray, rose-beaked Java sparrows flitted gaily about. Ngoman Gdé all but left the motor running while I was eating, and as soon as I stepped from the airy dining room he was at my side. It was the feast of Poernama—at the full of the moon—, and if the *toean* were not too fatigued after his ride, he had better go to the temple in the village.

We drove through Den Pasar's main business street, with its mean buildings, cheap curio dealers, laundries, Chinese and Japanese photographers, postcard vendors, and unattractive shops offering the worst European rubbish, and again I asked myself, "Why do I not make more careful inquiries and check my exultant fancy whenever I hear of some remote tropical region?" I might have sailed from Indo-China to revisit Samoa and Tahiti, where in spite of the Chinese and sordid white traders, beauty is still hidden in the distant valleys. Suddenly, we turned a corner, to gain the road leading to the temple gate,—and I was transported into an unbelievable world!

On this broad pathway, a high altar had been erected under a sacred banyan tree and decorated with floating banners known as *lamaks,* made of yellow areng palm leaves, on which a beautiful design had been interwoven with bright green leaves. Flexible bamboo poles, drooping with the weight of ornamental streamers, formed an avenue, down which visions of exotic beauty were marching toward the sacred portal. Along this highway an unbroken row of itinerant food vendors with small, portable kitchens were selling pawpaws, sugar cane, fried eels caught in the *sawahs,* raisins, peanuts, delicious mangosteens, pink grapefruit, white mango, and mysterious cooked dishes. They formed the background for the gorgeous parade of devotees, who came individually or in troops, often from distant villages. All carried offerings, usually arranged as pyramids of fruit or vegetables, exquisitely decorated with hibiscus, sweet-smelling frangipani, marigolds or other gay blossoms. How dignified these simple women were,

". . . Visions of exotic beauty were marching toward the sacred portal." Approaching the temple near the banyan at Den Pasar moved a gorgeous parade of devotees, worshippers of a living faith, carrying offerings of food and flowers for their gods. The floating banners are made of yellow areng palm leaves, beautifully interwoven with rich green leaf designs





THROUGH this characteristic cleft gate, or *tjandi bentar,* the procession marched, past the carved screen intended to hide the entrance from evil spirits. (Recent Balinese workmanship)

bringing offerings to their gods on their well-poised heads! Frequently large groups would arrive, all dressed alike,—some in green, yellow, and brown, and others in red, gold and purple, with flowers in their black, glossy hair or behind their enlarged ear lobes, in which gold plugs or cylinders shone. They moved placidly along, with proud bare breasts and bare feet, past the fierce-looking stone guardians (which today wore modest cotton aprons around their loins), to disappear between the curious parallel lines of an elaborately sculptured gateway, or *tjandi bentar,* into the first of the three courtyards in the temple grounds. Young bloods, their precious carved kris handles showing above their shoulders, carried narrow, flying banners attached to long poles.

As the day waned, other natives came bearing images, idols, and emblems under richly colored parasols, decorated bottles containing holy water, and huge wooden platters with skillfully arranged food offerings. Many were singing. Each small procession seemed lovelier than any before. Not one of the many altars was neglected, and an unholy trespasser like myself was awed by the simple sincerity of the worshippers.

Seated on a raised platform in one of the many covered pavilions in the last of the enclosures was a row of five solemn, long-haired Brahman priests, who made an imposing picture seen by dancing torchlight through the smoke of burning incense. Each wore a miter of crimson and gold, recited prayers, made mystic signs with their adroit, expressive hands, rang bells and accepted offerings for the great gods and lesser spirits. Nearby, little children squatted, listening intently to the *wayang kulit,* or shadow play, and to the accompanying music of its *gamalang,* which resounded above the din of prayer and temple gong. Nor were the evil spirits forgotten. To rid the grounds of them, the youthful banner bearers ran shouting around the temple walls three times, while a vigorous old man sprinkled them freely with holy water. Firecrackers were also exploded to frighten the demons away. Outside the main gateway enormous plates of unsavory food were left for those dangerous divinities who had not yet been driven off. Starving mongrels, prowling about, pounced without delay on these foul mounds of refuse, and amid snarls and savage growls, made short work of them.

Then night descended with tropical swiftness on this unbelievable scene. The haunting, laughing music of the *gamalang* (the native orchestra) called the surging masses out into the already crowded road, where dancers entertained them, and I knew that I had fallen in love with Bali.

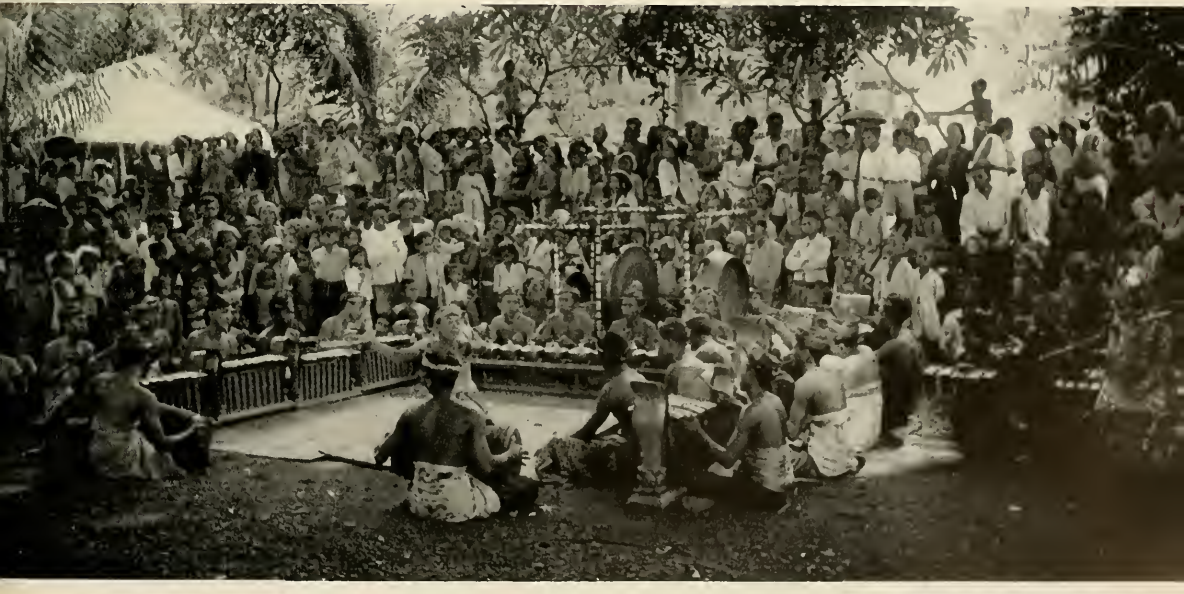
Ngoman Gdé divined my feelings and smiled discreetly. "*Toean* wish to see Sang Hyang?" he inquired. Naturally I was anxious to learn the meaning of those strange words, and off we drove. Apparently no "unclean" tourists had heard of this particular ceremony. All about us the frangipani was exhaling its incomparably delicious perfume. As we approached the temple precincts in pitch darkness, waves of sound reached my ears,—male voices yelling like American college boys: "Tsak, tsak, tsak, tsak." Then faster and faster in syncopated time, "Tsak-a-tsak, tsak, tsak-a-tsak," over and over again with many variations of tempo. I cautiously entered the enclosure to find the men squatting on the ground in a solid mass near a shrine. Two small girls, about ten or eleven years old, swathed in golden tissues, with lovely high crowns fashioned of mother-of-pearl and real flowers, were dancing before them. They were said to be in a trance, but this I could not confirm. Now gently swaying or running, now trembling with frenzied angular movements, or shaking their slender bodies like Egyptian stomach dancers, these two little virgins were, I believe, regarded as temporary embodiments of the spirits who were being worshipped. As my eyes became accustomed to the darkness, I saw that a group of women was seated some distance away. When the rugged, warlike song of the men ceased, these women began singing lyrical strains, and the character of the dance changed to female tenderness in graceful harmony with such hymns. On and on these frail but tireless children danced, without any visible sign of fatigue. When Ngoman Gdé whispered that the ceremony would not end till dawn, I left reluctantly, for I had discovered that Sterne's Bali was still in existence, and that there was to be no rest for me on this exciting island.

I had been told that to know Bali I must become acquainted with Walter Spies, who had settled in the distant village of Oeboed to make a thorough study of the *gamalang* and its music. Only natives are permitted to own land in Bali, and Spies had built an enchanting house on a leased tract at the edge of a picturesque ravine through which ran a stream. To reach it, I motored along an exceptionally beautiful road. When the aisles of banana trees and palm groves gave way to rice *sawahs,* I enjoyed views of Goenoeng Agoeng, or the Peak of Bali, rearing its great cone 10,000 feet into the air. Men and women, not always in separate groups, were washing themselves unashamed in the yellow creeks running along the road. Children were comparing their fighting crickets which were imprisoned in small bamboo cages. A goose boy, built like a young Hermes, controlled his snow-white charges with a flexible bamboo rod, to the end of which a few feathers had been loosely tied. Herdsmen in shaded pools were sprinkling their beautiful, soft-eyed, brown-and-white cattle, which were descended from an agile, wild variety. And everywhere—in the villages, in the rice fields, in the trunks of aged banyan trees, and in private houses—were temples and shrines. Obviously these people believed in the power of their gods.

I soon learned that Spies was not only an excellent musician but a good naturalist and a painter of remarkable pictures, which breathed the very spirit of Bali. His thatched house, built in part without nails like a finely constructed Fijian abode, was a storehouse of Balinese art. In the garden he had a veritable menagerie of pets, including monkeys, doves, cockatoos, dogs, and even a python. He had made careful piano transcriptions of the music of various *gamalangs,* arranged for eight hands. Admitting that he could not reproduce the peculiar booming quality of the deep, reverberating metal bells, or imitate successfully the gentle, liquid oboe note of the bamboo gongs, nevertheless, even on one piano, he played extracts that were very satisfying. He encouraged the native dancers and musicians to keep their traditions alive. For several years he had been carefully copying over 500 of the inexhaustible series of unique designs on the fragile, perishable *lamaks,* classifying them according to motif and place of origin. Whenever he found a hitherto undescribed spider, slug, or dragonfly, he made scientifically correct water color drawings of it. Sculptors, weavers, draftsmen, and carvers of bone found in him a ready purchaser of their best products, and with the Dutch artist Bonnet he was a leading spirit in building up the collection at the Den Pasar Museum, which is incidentally an excellent example of native architecture.

Spies was so pleased with my appreciation of his adopted island that he promised to unveil the real Bali to me. When night fell, we went to the village of Behdoeloe, where great crowds had collected in an open square to witness a dance called the "Katchak." This dance lasts about an hour and differs in certain ways from the more typically Balinese dances. Several hundred men, nude except for a loincloth, had already squatted down in a mass of uneven, concentric circles, around a carved, wooden candelabrum stuck into the ground. Its branches supported three flickering torches. From a distance, the glistening bodies looked like a great tropical blossom, blooming in the starry night. We, the spectators, stood like fascinated ghosts in the obscure world beyond this colossal flower. The *gamalang* had no place in the performance, but at a hidden signal given by one of the leaders or key men, a sharp, deafening cry arose. All the men were now alert, their shining bronze faces lighted by the dancing flames. As the action developed, they leaned forward, their nude torsos exuding male strength, and they uttered rhythmic, muffled cries, like sighs of infinite exhaustion, as though they were suffering from some hidden frustration. Then the volume of sound would increase and end in a great roar. The air vibrated with lusty cries. Bodies swayed, arms and hands were brought into play, and their thousands of fingers trembled like aspen leaves. Gaunt demons threatened them, and their despairing cries changed to a sharp staccato. The soloists representing

THE GAMALANG (native orchestra) weaves the melody while the well-known dancer, Goesti Ngoerah Regog, performs the Gong Kabiar, a dance which expresses the emotions of terror, coquettishness, and serene pleasure by deft motions and postures. The music suggests Bach, but the scale and intervals differ entirely from the European



benevolent or malign spirits appeared and disappeared with magical suddenness. Finally, aroused to a religious frenzy which knew no fear, they leaped upon one another's shoulders, building a living wall around the last and most powerful of the malevolent fiends who were attacking them. The living palisade advanced and retreated but never broke. Realizing that he could not overcome them, the evil one at last escaped into the dark jungles, followed by the shrieking men. The Katchak was over, the plaza in the village was empty—and you were left breathless and awed by the savage intensity of the finale.

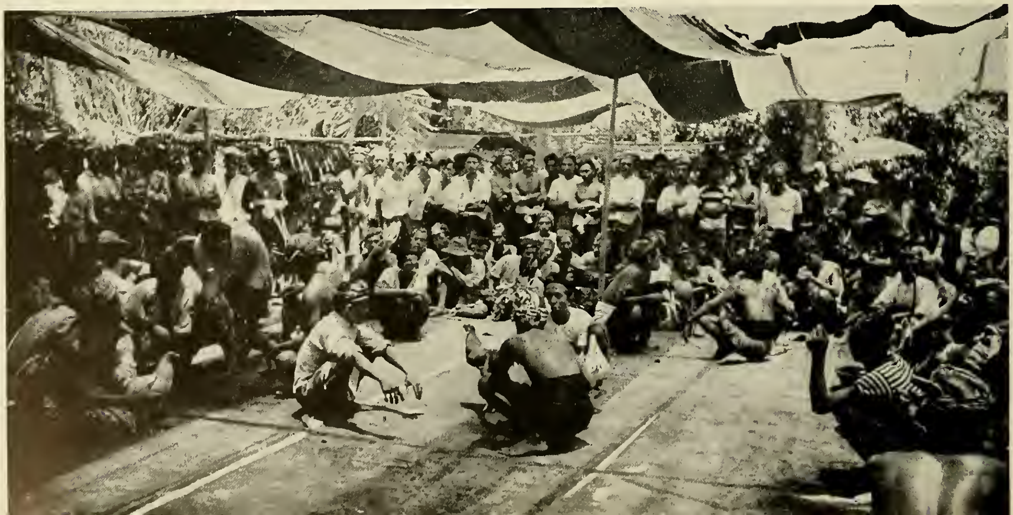
On the following evening when I rode back to Den Pasar, brilliant fireflies hovered like supernatural spirits over the *sawahs.* Answering the call of the *gamalang* on the roadway, I found that this time no public performance was in progress. Goesti Ngoerah Regog of the village of Tabanan, a well-known dancer, was merely giving a lesson to a little boy, who could already take the mime's part in the Gong Kabiar. In this dance the lone performer, holding a fan and wearing a long, trailing, silk sarong, is seated on the ground, surrounded by the orchestra. He expresses various emotions with his eyes, face, lips, fingers, and entire body, which sometimes moves swiftly from one point to another without showing the performer's feet, covered as they are by the long sarong. The music is an intricate web of themes and variations rarely containing a melody in our sense of the word, and with a scale and intervals differing entirely from the European kinds. Nevertheless the music suggests Bach. All the instruments are played by percussion. Although there is no conductor and no written music, the players, who depend like Hungarian gypsies solely on their memory, seem to keep a close watch on the principal *gangsa* (a kind of cymbalo performer).

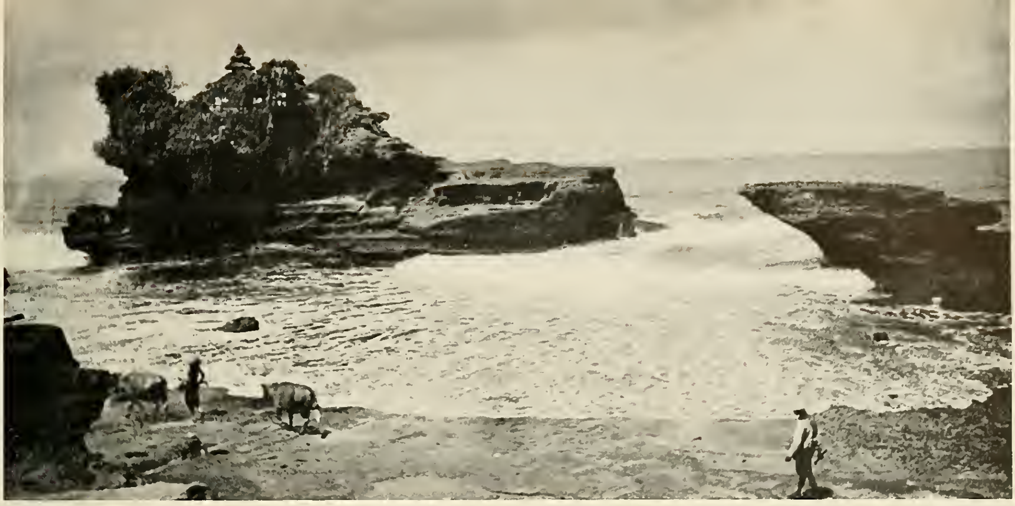
While the men played, the clever, diminutive dancer suggested terror, joy, coquettishness, fury or serene pleasure. He was not unlike one of our own *Wunderkinder* who superficially imitate a Kreisler or a Pachmann, although with no profound passion.

When Goesti Ngoerah Regog was not satisfied with the performance he took a position behind the boy, held the child's flexible fingers between his own, and forced the little fellow again and again to execute the swift complicated patterns of hands, arms, and fingers, while the *gamalang* wove its frenzied measures. At first he seemed to be a capricious, elegant lover, but without any transition he changed into an impetuous warrior. Other children were looking on absorbed, and not infrequently the master would persuade one of these to try his skill. All the people enjoy such entertainments, which are like free communal festivals.

Almost invariably I was the first to leave the nocturnal meetings, for I knew that Ngoman Gdé expected me to start on the next excursion bright and early. One morning he took me to the fishing village opposite the island of Noesa, and we arrived in time to witness the blessing and consecration of a new house occupied by an interesting German family, who were expert herpetologists. Frau Neuhaus, not only created remarkable dolls but also assisted her two sons in making perfect replicas of reptiles and fish in various media. They had just completed a book on the poisonous reptiles of Java and Bali and were now building an aquarium close to the shore. The natives took an active interest in such work and brought many rare specimens to fill the tanks. Several hundred people came to the religious ceremony, bringing the usual offerings to an altar erected on the beach in front of the new dwelling. A long-haired *pemangkoe* officiated. As always, the dangerous, unfavorable spirits received their share of food and attention, and when the ritual came to an end, Balinese mongrels were there, ready to fight over every scrap of food left uneaten. Young Neuhaus informed me that these dogs performed a valuable service to the community. They were the island's chief scavengers. Rabies was unknown, and for that reason no dog, cat, or monkey was permitted to land in Bali. An English humane

RELIGIOUS IN ORIGIN, cockfighting persists against modern opposition. Almost every man brought a gamecock to the red and white striped tent below, and the crowd was democratic, but there were no women. The sportsmen make offerings at the altar of the God of Cockfights. Four-inch spurs of double-edged steel are fixed to the left leg of each fighter, bets are laid, and the struggle is usually short and swift





AN ISLAND TEMPLE situated in peaceful isolation just offshore near the village of Teglod. At low tide it can be reached on foot

society had mercifully killed about 70,000 incurably sick dogs, but many thousands were still left to do the work of vultures.

After we had finished drinking rice wine to the happiness of the household with the *pamangkoe* and *poengawa,* or district head, we all repaired to a neighboring field where a great cockfight had been arranged with the consent of the authorities. Unsuccessful efforts have been made to discourage the sport, which was religious in its origin and was once regarded as a blood offering to the gods. Ngoman Gdé enjoyed the excitement but he soon learned that his *toean* preferred to see dancing—the plastic expression of the spiritual life of the Balinese—, and we became familiar figures at such performances.

I have touched upon Balinese artistic activities in a separate essay,* and most of the dances have been described at length in the books of Spies and Covarrubias, published after my visit to Bali. It may be noted here, however, that with each type of dance or play, the instruments vary and also the music, which has the character of an improvisation closely following the action. It was always a pleasure to see the young artists, who are trained from earliest childhood, make up for these dances, painting additional hair on their brows, ornamenting their heads with fresh blossoms, fixing their glittering tiaras or powdering their bodies. When their toilets were finished, they invariably knelt before the altar in the temple grounds and were sprinkled with holy water before commencing their performance.

One is always missing something in Bali. While I was off in some distant village to see a dance, a tooth-filing ceremony, a six-month birthday celebration, or a wedding might be taking place at Den Pasar. So with my untiring guide, I would start out each morning for some unexpected artistic or romantic adventure. It might be a pilgrimage to the little temple built on a high, rocky islet off the shore at

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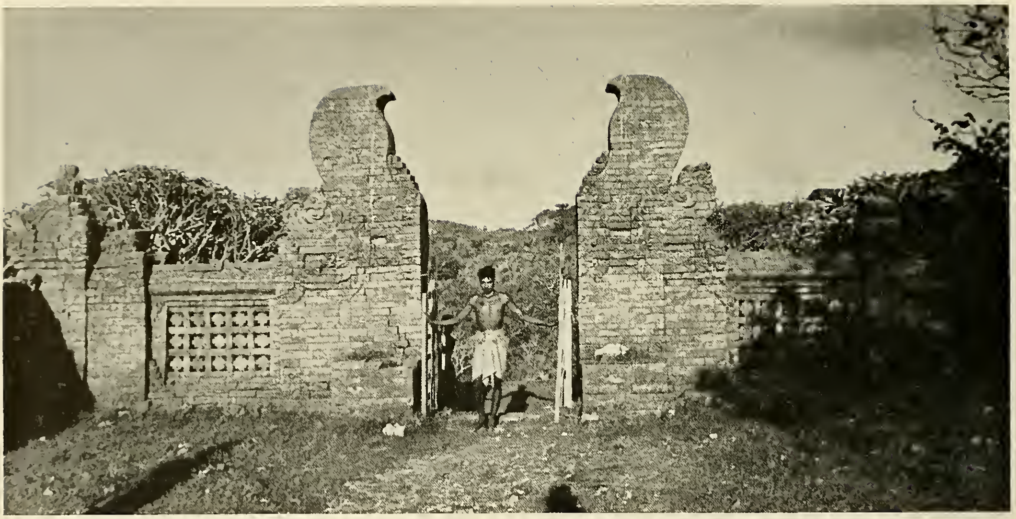
*See "Contemporary Art in Bali," by Martin Birnbaum, *Asia* Magazine, April, 1936.

THE REMOTE southerly cliffs of Bali, on which a unique *poera,* or temple, is built, are not often visited by many travelers. The gateways of its first and second enclosures are shown on the following pages



THE ENTRANCE to the first enclosure of the temple on the high cliffs of the southernmost shore of Bali: architecture of a style seen nowhere else on the island. It is difficult to determine the age of sculptures or buildings in Bali. The soft native stone cannot resist the wear and tear of time and moisture, and the natives are kept busy repairing deteriorating works

Teglod, or a visit to the more ancient *poera* on the high cliffs of the most southerly point of Bali, where the wall reliefs and doorways differed from all others I had seen.

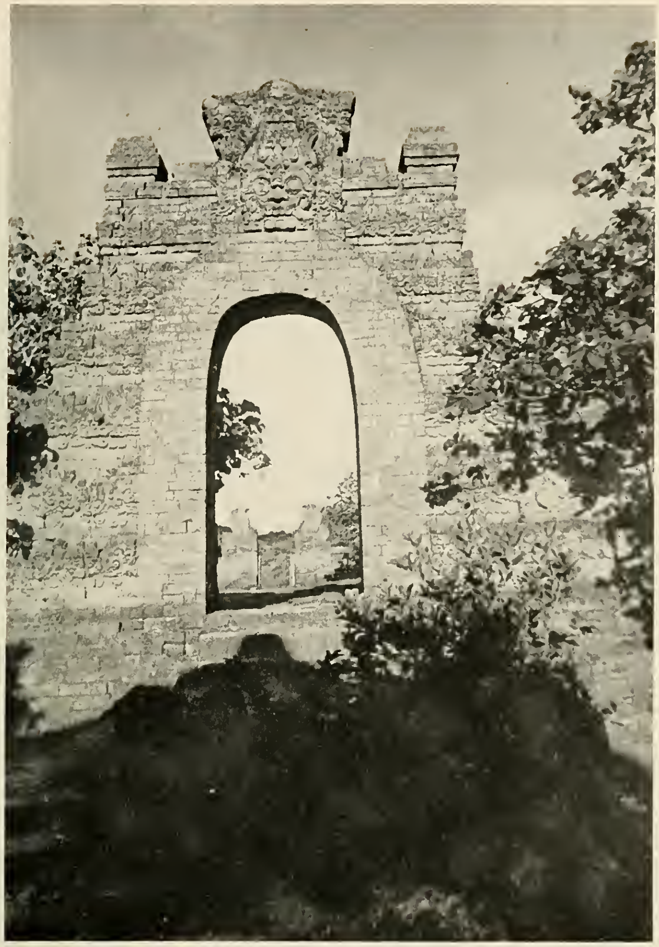
Most enjoyable, however, were the walks I took in the company of Walter Spies. Together we went to the Hinduistic temple or cave of an ascetic, known as the "Goa Gadjah" (near Behdoeloe), over the entrance of which a fantastic evil genius had been carved from the living rock. Not far from it were the even more interesting primitive reliefs of Toya Poeloe, which will soon be obliterated unless something is done to protect them from the percolating waters of the *sawahs* surrounding them. Spies was greatly concerned over their preservation and he showed me other sadly damaged relics at the highly venerated temple of Panalaran at Pedjeng, which was probably the old religious center of Bali.

There I tried to photograph the great sacred gong, said to have been an earplug of the moon from which it fell. My task proved almost impossible, for it was virtually hidden by a high, wooden scaffolding. It is decorated in a unique manner with human heads in very low relief, and although much larger than any gongs in the famous collection of the Musée Finot at Hanoï (Indo-China), this magnificent bronze shows certain similarities. With the ancient sculptured fragments of Brahma, Vishnu and Siva, which are crumbling to dust in other pavilions at this same temple, the gong ought to be taken to the Den Pasar Museum, but the religious Balinese will probably not permit such a sacrilegious removal.

After my secret photographic efforts we went to the celebrated royal tombs, hewn from the perpendicular rocks on either side of the Pekrisan River, near Tampaksiring. On these are inscriptions in the ancient language of the Kediri district, which have been deciphered, but there still seems to be some doubt as to the identity and rank of the persons buried. On one side of the gorge there are five tombs, or *tjandis,* of a princely ruler and his wives; while the four tombs on the opposite side are said to contain the ashes of ministers. Nearby are many empty, rock-hewn cells formerly belonging to ascetics of a now deserted monastery. Offerings are still made on the ruined altars, and in the narrow corridors we surprised a number of pilgrims who were bearing the usual lovely gifts. At Tampaksiring itself there were more worshippers, who came to the sacred springs of Tirta Empoel to be purged of their sins. Here the water bubbles up through volcanic sand and is carried off into various basins. The original spring is reserved for the gods; while the other pools are for native men and native women, and one may even be used by foreigners.

On one of our excursions we drove to Lake Bratan, at the foot of Mt. Tabanan; and at all the cross-roads we passed statues of the God of Roads and his disciples. We even penetrated the mysterious jungle on the shore of the lake. The finger-like roots of the giant pandanus hung menacingly in the air above our heads, and the boy who carried the orchids we had collected was plainly anxious to leave this unholy, sunless wood. It was a passionately wild growth, with a few gaunt trees soaring above the common level. Creepers or clinging epiphytes struggled for life and air with magnificent abandon. While Spies told me of the glories of the unexplored forests covering the western half of the island, where the tiger still reigns supreme, we gathered armfuls of ground orchids, discovered monkeys, green doves and a *kap-kap* (large squirrel), and studied the dazzling dragonflies and butterflies.

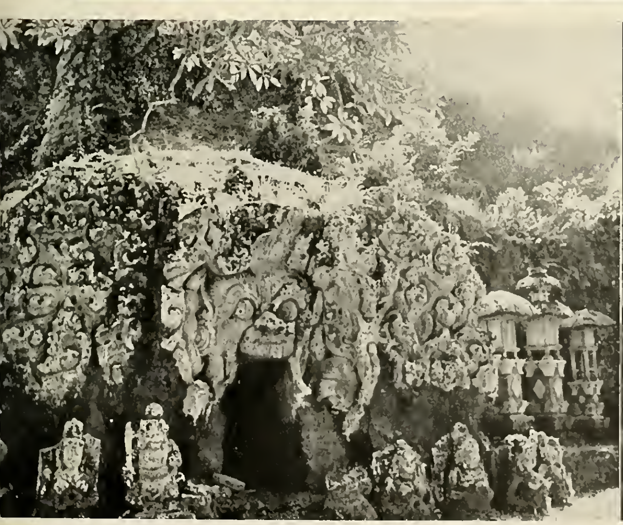
Spies told me that although March is not the sea-

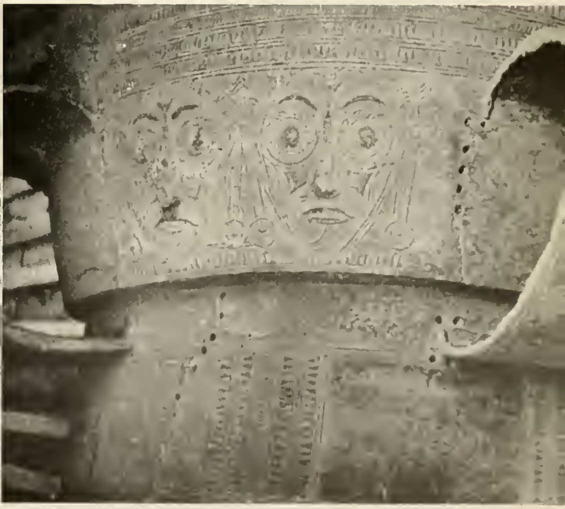


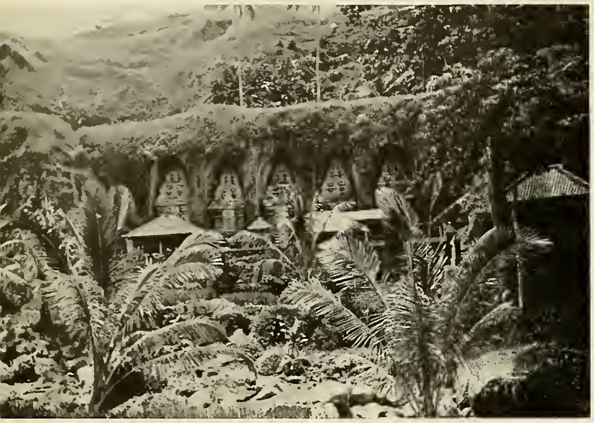
THE UNIQUE ART of the builders of this *poera* is evident again in the reliefs of the second gateway to this southernmost temple of Bali. A view looking through the arch toward the outer entrance

(Lower left) CARVED from the living rock: a Hinduistic cave of an ascetic known as the "Goa Gadjah," near Behdoeloe. A rakshasa, or evil spirit, guards the entrance. Not far away are the equally interesting primitive reliefs depicting a hunting scene. These will soon be obliterated unless something is done to protect them from the percolating waters of the rice *sawahs*

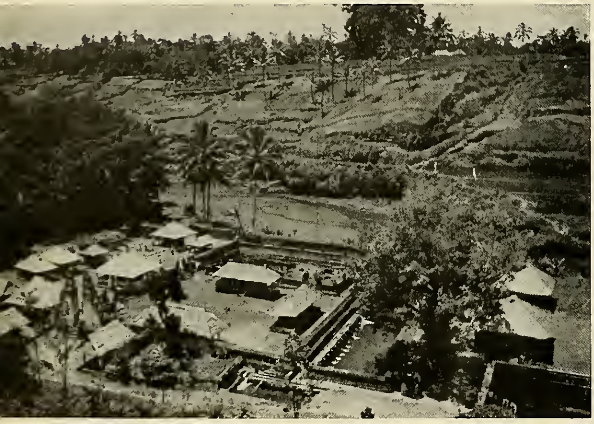
(Below) A HUGE GONG at Pedjeng, the oldest religious center of Bali: a work of art probably never before photographed. Hidden by a high wooden scaffolding and regarded as extremely sacred, the gong presented problems not usually encountered in the photographing of native art. It is decorated in a unique way with human heads in low relief and borders of sawtooth pattern. The Balinese say this gong is a cylinder fallen from the ear lobe of the moon



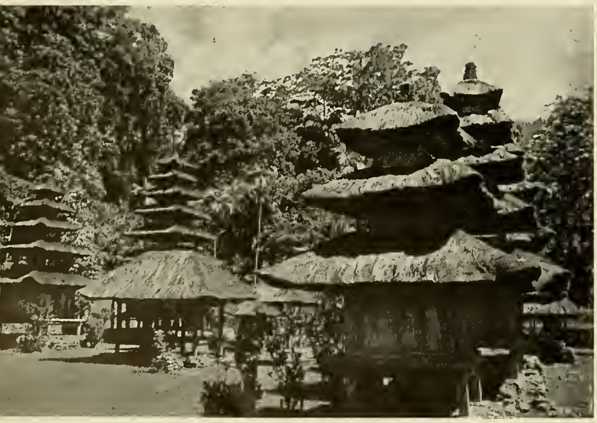




(Above) ROYAL TOMBS carved in the rock near Tampaksiring. In the crypts the body of a prince and his wives are said to repose



(Above) A BIRD'S-EYE VIEW of the sacred springs of Tirta Empoel at Tampaksiring, where pilgrims come to bathe, to be purged of their sins



son for funeral ceremonies, some of the eastern villages might start building cremation towers by reason of the exceptional dry spell. Thus encouraged, Ngoman Gdé began a search. At every village men were repairing the temples, or adding new sculptured figures to the portals. The character of the vegetation changed as we ascended the foothills of the majestic Peak of Bali, and the wide vistas became grander at every turn. At this altitude the people were actively engaged in farming and cattle-raising. Toward noon we reached Besakih, about 3000 feet above sea level, where we saw the celebrated and most sacred of all Balinese temples, built on a series of terraces. A steep stairway of 49 steps leads to the main gateway, and the superb wooden doorways are covered with decorations in relief. Each district has enclosures of its own, containing shrines and *meroes* to which annual pilgrimages are made. As all are built on different levels, the effect is very impressive. A long-haired priest and his manly young son showed us about and presented us with live poultry and oranges from their orchard.

In the course of this long search for a funeral, we wandered about the villages, ventured into hospitable private homes, and witnessed many phases of Balinese life new to me. We watched the women weave their many-colored sarongs with borders of silver and gold threads, and saw the sculptors carving the soft native stone into gods, with no models or designs to guide them. A boy would be drawing a jungle in which fierce tigers prowled and poisonous-looking flowers bloomed, while his father was carving the head of a deer, into which he inserted genuine antlers. The trembling hands of a very old man were still fashioning Garudas and kris handles, and attentive pupils were always studying the progress of such work.

In preparation for the Dutch Governor General's visit, stalwart workers paid their taxes by repairing the road down which farmers were carrying golden sheaves of rice that swished at the ends of bamboo poles. Temples, literally by the thousand,—to the gods of mountains, rivers, rice fields, roads, trees, and to Baroena, Lord of the Sea—were built everywhere, and the variety and originality of the decorators' art was never exhausted.

Apes are often seen on the reliefs, and in the holy grove of nutmeg trees at Sangeh, troops of impertinent, sacred monkeys are always waiting to be fed by visitors. The leader was ravenous when we arrived there and forced my hand open till he had devoured every available grain of corn. None of his wives, children, or rivals dared to approach till his greed was satisfied, but unexpectedly a beautiful, harmless striped snake fell from a tree, and there was a wild scattering and chattering.

In the grove, tall pala trees that no one may fell,

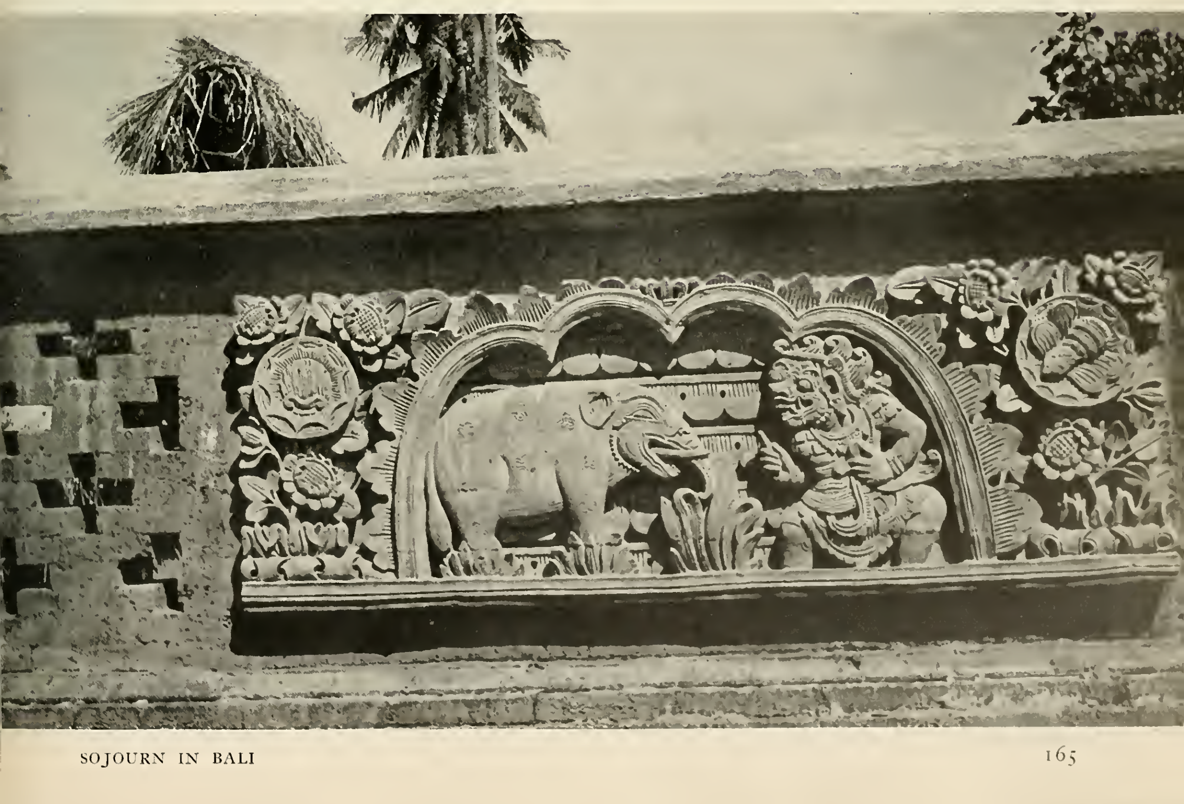
(Left) A HIGHLY VENERATED spot to which annual pilgrimages are made by all Balinese: a scene at Besakih. Here in the hills, at an altitude of about 3000 feet, a great number of pagoda-like *meroes,* the earthly abodes of deities, are standing at different levels on a series of terraces. The *meroe* of Siva the Destroyer, most powerful of all gods, has eleven stories

rise to uniform heights, and the winged nuts are gathered by the natives, who use the powder to keep their bodies cool. When I left the grove I came upon a young girl who held a long, swaying stick in her hand (probably the central vein of a nipa palm leaf), at the end of which were a few spikes on which the sticky juice of the nangka or jack fruit had been smeared. Dragonflies settling on it were immediately caught and gathered in an apron, to be roasted in oil and eaten. Wafers of toasted bees are another delicacy and reminded me of the African termite feasts and the locust eaters of the African desert.

Not far from Sangeh on the outskirts of the village of Bongkasa, Ngoman Gdé insisted on making another detour, for he wanted me to see a banyan, which is not only one of the largest but also one of the most beautiful, natural arboreal wonders of the world. Over 10,000 square yards are shaded by this superb tree, and hundreds of new aerial trunks are adding annually to its unbelievable grandeur. It was under such a tree that the Buddha meditated on the sufferings of humanity, and one might well be inspired to find truth in this mysterious green mansion. Many temples and shrines have been built under its boughs.

At last, when we had almost given up hope of attending a funeral, Ngoman Gdé came in great excitement to tell of a double cremation which would take place at a village on the southeastern coast, beyond Kloengkoeng. Naturally we took the shortest road. Upon our arrival I was at once surprised to find no visible signs of grief. On the contrary, a gay, festive air reigned, and the bereaved families and relatives invited us into their houses, where they laughed and chatted around the bodies of the deceased. Had they shown sorrow, the spirits of the dead would linger in the neighborhood, instead of going on their allotted way to the region of the blessed. A very old man had died, and the bodies of several younger members of his family, who had long predeceased him, could now be prepared, ceremonially, and all were to be burned together. It would be indelicate for young spirits in a family to start their heavenly journey before the older members were ready to depart. In this village the bereaved families were not very rich, and the two *wadahs* decorated with colored tissue paper, tinsel, and streamers, although very gay, were not comparable to the magnificent casket towers prepared for the bodies of nobles. While old women were preparing food and offerings, the *gamalang* was playing for the crowd and did not stop till the men shouldered their instruments to take them to the cemetery. Then about a hundred men wearing only loincloths prepared to remove the eight or ten bodies, which had been wrapped in a series of plaited mats, to the topmost stories of the towers by means of inclined planes. There were Polynesian, Malay,

This carved stone panel of a temple wall is an example of contemporary Balinese sculpture and testifies to the present-day vitality of native craftsmanship. There are no Balinese words for "art" and "artist," and no one asks the name of the creator of a sculpture or drawing. In Bali, life itself is a communal artistic festival



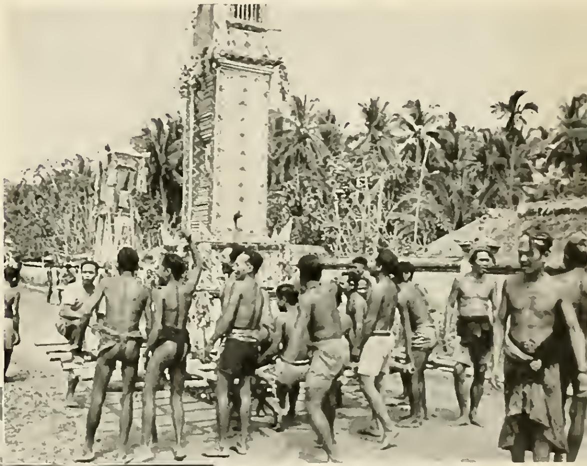
Papuan, and even Chinese types among these natives.

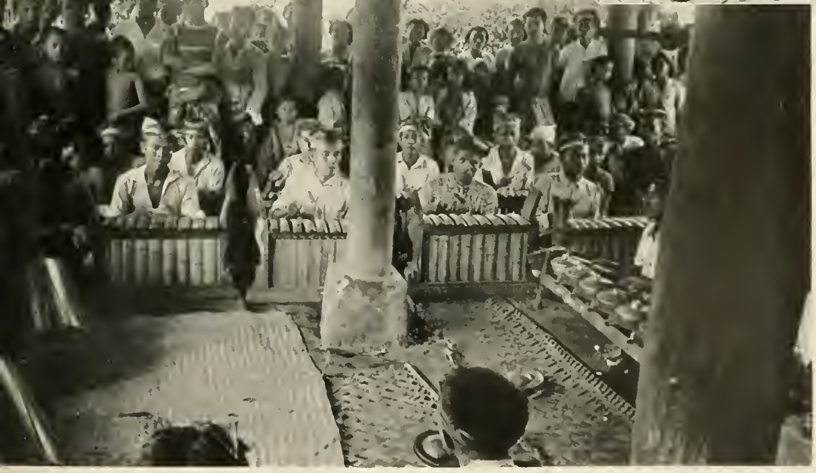
Amid loud shouting and frenzied excitement they seized the bamboo platforms on which the two towers rested and started down the road followed by the populace. The women sprinkled holy water on them, and boys who clung to the towers threw Chinese cash into the scrambling crowd. The carriers made very slow progress. To confuse evil spirits they moved in an uneven line, repeatedly circling about, and there was always danger that the swaying towers with their ghastly burdens would topple over. It had been raining the previous night, and the road leading to the beach was converted into a sluggish stream of deep, almost impassable mud; but nothing could stop these men. Through the black morass they waded. We went by a roundabout way along the raised boundaries of the *sawahs* to the cremation field adjoining the sea. When we reached the shore the nude porters were already up to their heads in the breakers, taking a short cut through the water to the meadow on the other side of the bay, where the bodies were to be burned. As the current was swift, the men had great difficulty in supporting the swaying *wadahs,* but the danger only added to their gaiety, and when they had successfully avoided disaster and landed the towers on the sands, they all rushed back noisily into the sea for a swim, before the gruesome business of the day was begun.

Wooden funeral pyres were constructed, each with partitions for the bodies. The mats were unfolded, and the decayed cadavers or what was left of them, were washed with holy water brought in pots by friends and relatives of the deceased. A long piece of cheesecloth was held over each body, holy water

(Left) AN AVENUE of decorative figures leads to a temple in the hallowed grove at Sangeh, inhabited by a tribe of sacred monkeys. This sculpture is of recent origin, though the green moss which soon covers the stone gives an appearance of great age

(Above) The old Water Palace at Kloengkoeng, which lay on the author's route to the scene of the remarkable cremation ceremony depicted below. The famous Hall of Justice, with its celebrated painted ceiling, is nearby





(Above) A FESTIVE spirit prevails at Balinese funerals, otherwise the spirits of the dead might linger and torment the living. The men are preparing to carry the funeral towers to the cremation field near the sea. This was the funeral of a small group of deceased Balinese, not aristocrats

THE *GAMALANG (left)* played for the light-hearted crowd until the funeral towers were carried away on the shoulders of 100 men. To confuse the evil spirits, the procession followed a winding route to where the ashes were consigned to the waves and flowers were poured over it, and a man washed and scrubbed the dead with the water which trickled through the cotton sieve, on which only the blossoms remained. Cards were attached to each pot of offerings, and the donor would usually break the earthenware after its contents were strewn upon the remains. Emblems were also placed on the bodies, and after every compartment was filled with a corpse, the entire mound was covered with inflammable twigs and set ablaze.

Thick wreaths of smoke arose, and all the people settled down to wait for night to fall. The ashes would be returned to the towers and then cast into the boundless ocean. If any part of a body remained intact, the departed could not continue on his or her celestial journey but would haunt his native town. Ngoman Gdé advised me not to wait for the fiery end of the picturesque ritual, because a kris dance would take place at twilight in Den Pasar, and I did not regret leaving the scene.

The strange, symbolic performance that I was now about to witness, will ever remain inexplicable to me. In a shaded glade crowded with natives, near the temple of Den Pasar, umbrellas and streamers had been stuck into the ground, indicating that the region was a *Gefilde der Seligen,* where maidens wearing coronets danced stately measures, and virtue reigned supreme. Soon, however, black demons, representing the deadly sins, mingled with them. The age of peace, good will, and heavenly bliss came to an end, and the triumph of vice was celebrated by a horrible Rangda with fangs and a long, forked tongue, who pranced about gleefully with a kindred evil spirit. Then a noble lion or Barong appeared on the scene to struggle with the dread demons, but he was unable to vanquish them and retired from the unequal struggle. Meanwhile I had noticed a group of powerful, wiry men and adolescents, squatting at one end of the long open space formed by the audience. They worked themselves into a trance and began to stare like wild men at the monstrous witch. Foaming at the mouth, trembling and possessed, weeping hysterically or making strange uncontrollable "epileptic" movements, they seized their krisses, arose in a body and rushed at the destroyer. The Rangda held her ground, and the fanatical horde, in danger of being embraced by those devastating claws, retreated. When she attempted to run away, however, they gathered courage and followed. Up and down the glade they ran, pursuers and pursued, until she escaped. The

(Left) THE DAG, or teacher, who takes part in the dances. The Balinese dance is a vital and spontaneous phase of life on the island, and there is no immediate danger that the dramatic traditions will be forgotten. All the people enjoy the entertainments, which are like free communual festivals. Frequently a local ruler will arrange a performance at his own expense

(Right) THIS PLAY is based on a story in the Mahabharata. The prince Arjuna, a male role allotted to a well-known actress, overcomes a demon who assumes the shape of a monstrous bird. The hero's attendant on the right is the veteran actor shown in the photograph at left

tension never relaxed, and now a really terrifying scene ensued. In their disappointed fury, these *permadis* turned the sharp krisses on themselves and attempted with all their maddened might to pass the curved blades through their chests and abdomens, but the gods did not permit such sacrifices. Try as they might to pierce themselves and force the weapons between their ribs, some strange hypnotic power prevailed, and they never succeeded. They writhed in agony and ran amuck in the surrounding crowd, which scattered and fled. Finally some picked strong men rushed forward and forced the fellows to give up their weapons. Ready to faint with exhaustion, they stood for a moment as if drained of all strength, but in front of them stood the benevolent Barong, and as each pale man, physically and spiritually tired, saw him in turn, he embraced the weird mask and buried his perspiring head in its mane. Only then was he again transformed into a frail, normal, suffering mortal. I was told that frequently serious wounds were inflicted on the spectators by the irresponsible dancers, and I can well believe this. No one has as yet satisfactorily explained to me why these men and boys were rarely even bruised by those sharp, pointed krisses.

Excited and mystified by such incredible ceremonies, I left Bali before the spell was in danger of being broken. Already an erstwhile princess who refused to sacrifice herself on her husband's funeral pyre was persistently trying to sell me cheap tourists' trinkets. Other importunate, rascally natives were asking fees for showing salacious reliefs on the walls of a temple. Are these the descendants of heroes who committed suicide by thousands rather than submit to white domination? Is it possible that all the beauty I had enjoyed would become a mere legend and a memory? The more I scratched the surface of Balinese life, the more clearly I realized that my allotted time would prove all too short. Moreover, without the expert and kindly advice of Spies, my visit would have been an even more confused experience. So I left for Java while the unforgettable island still exercised its powerful fascination. Although a mist enveloped the coast, volcanoes showed their cones above the clouds, and a sunset lighted the clearing sky with an orange flare, only to disappear again as if by magic, leaving me in a twilight which filled the world with sadness. Then night became a fathomless flood of blue, sprinkled with golden stars, and Bali melted in darkness.

MYSTERY PEOPLE OF THE ARCTIC

Continued from page 154

work. No stones or whale bones were used. The houses were not half underground like the other permanent dwellings of the Eskimos, although the floors may have been two feet below the surrounding surface. There can be no doubt that these were permanent homes and that most of them were occupied for a number of years, since there are rich deposits of débris upon the floors, now buried beneath a thick compact layer of sod and turf.

After a tedious search we found the cemetery of the Ipiutaks. No signs of the burials were noticeable on the surface; they were found only by excavating innumerable test pits over an area one and one-half miles long and a quarter of a mile wide. Apparently the finest and most prized possessions of the Ipiutak people were buried with them, since in the graves we found much more elaborate material than in the houses. Well-preserved burials were rectangular, log-walled tombs containing one, two, or three skeletons with their implements for use in the after world. The driftwood logs used in constructing the tombs had become a soft, fibrous mass, in which the skeletons were often completely imbedded, but the original rectangular structure could still be recognized.

Of the more than 60 graves discovered, the most exciting, particularly to our Eskimo workmen, were those in which the skulls were equipped with large, ivory eyeballs, inset with jet pupils. There were three of these, and one was also equipped with a carved ivory cover for the teeth, as well as two ivory nose plugs carved to represent birds' heads. The original eyeballs had apparently been gouged from the skull of the corpse, then replaced by the artificial ivory eyes. The bones of the skeleton were still in place, proving that these were not second burials of skeletons interred after the flesh had been removed.

One of the oddest burials I have ever seen was that containing a large male skeleton. Between the thigh-bones of this skeleton lay the tiny skeleton of a very small child. And thrust through the body of the adult, along the spinal column, was an ivory back-scratcher, carved at the end to represent a human hand. Most of the bones of this skeleton were still joined, but it was obvious that the body was at least partly dismembered before burial. Over it lay five long tubes carved from caribou antler; and under the pelvic bone lay a carved ivory chain attached to carved figures resembling polar bear heads. At the knee was the skull of a loon, with ivory eyes like those in some of the human skulls.

Some of the tombs contained arrowheads, flint tools, needles, and other recognizable implements, but most of the many hundreds of objects found in them are unidentifiable. Many are elaborate ivory carvings often cut in a curious spiral form, which the Eskimos began to refer to as *nukpori,* their word for a pretzel-like biscuit made of flour paste and fried in seal oil. Very few of the objects were known to the Eskimos, who were as puzzled by the vast, ruined settlement, the graves, and the curious implements, as we were.

Speculation and excitement in the village increased as more graves and more elaborate ivory objects were found. The wonder of the older people was expressed in the common statement, "But there is no story for this!" Their own history and the nature of the world in general is always explained in legends, which have been passed on from one generation to the next; and in any unusual situation, the old people are called upon for the "story," which will explain everything and at the same time determine what to do about it. The best contribution that the old people could make was to recall that parents a long time ago warned their children not to stay out late at night because they might meet a man with ivory eyes.

We, as archaeologists, have a difficult problem to explain the Ipiutak culture. We know from the bone refuse that these people were meat-eaters, dependent largely upon seals, walrus, and caribou. But they were apparently unfamiliar with the majority of well-known Eskimo implements. They had learned to make the toggle-headed harpoon, but from the relatively few examples found we can hardly believe that they depended to any great extent upon this important implement. In place of the commoner tools, they had a large number of peculiar implements, often finer and more delicately made than those of the present natives. There are no remains of sleds or boots, no rubbed slate tools so typical of all Eskimos, no pottery, no seal-oil lamps, and little of the gear used by Eskimos in hunting on the pack ice or in boats in open water.

We conclude that, although they lived in an environment not unlike that of the present Eskimos and hunted the same animals, except for the bowhead whale, the Ipiutak people had not developed or adopted Eskimo material culture as we know it. How then can one explain so large a population dependent upon animals for food?

Size of settlement

There is one possible explanation. When Kotzebue, Beechey, and other explorers first investigated the Arctic Ocean north of Bering Strait, they found a temporary summer settlement of Eskimos at the head of Kotzebue Sound, estimated to number at least 1000 persons. In summer these Eskimos came down the great rivers of northwestern Alaska to trade with each other and with people from Bering Strait. During the early summer they lived by taking large numbers of belugas, or white whales, in the shallow entrance of Hotham Inlet; and later in the summer they were able to net quantities of salmon. In the fall they went back up the river to fish and to hunt caribou in the interior. It may be possible that Ipiutak represents a similar seasonal concentration of people. Under present conditions they could not take belugas or salmon in sufficient numbers to support so large a population. But it is possible that walrus once "hauled up" in great numbers on the Point Hope bar to rest or breed, or that many seals could be taken there as the pack ice moved north. The Eskimos at Hotham Inlet lived in tents, and no large group of house ruins can be found there. If the Ipiutak settlement can be explained as similar, the people must have returned annually to permanent houses occupied year after year.

Again we must ask, who were these people and where did they come from? Comparing Ipiutak styles of engraving with those prevailing at other prehistoric sites in the Arctic, we recognize at least some resemblance to the work of ancient Eskimo people of northern Bering Sea. This clue is significant, because an unmistakable similarity in art work implies a definite connection, which in this case would seem to be with the most ancient Eskimos of the western Arctic, the so-called "Old Bering Sea Eskimos." But the latter possessed a material culture not very different on the whole from that of the historic Eskimos, while the Ipiutak culture departs so widely from this basic and ancient pattern that there is little real connection other than in the art style.

At least two explanations are possible. Either the Ipiutak people lived before the typical Eskimo culture developed in what is now Alaska or they were a foreign group who entered the Arctic from the south during an early period. If they came sometime during the many centuries since Eskimo people have lived there, they obviously took over only a small part of the Eskimo material culture and in turn had little effect upon the Eskimos. It seems hardly plausible that so large a group in a sparsely settled area could have had so little relation with neighboring people. It is more probable that the settlement of Ipiutak was occupied before other known settlements in Alaska.

Links with Asia

One of the most striking features of the Ipiutak material is the elaborate and sophisticated carving and the beautiful workmanship, which would not be expected in a primitive, proto-Eskimo culture ancestral to the modern. This suggests that the people of this Arctic metropolis brought their arts from some center of cultural advance and that they were immigrants from some southern region where their forebears had a well-developed Neolithic or New Stone Age culture adapted to the hunting of both land and sea mammals. Higher centers of primitive culture lie closer to the Arctic coast in eastern Asia than they do in America. Therefore it is toward Asia that we turn in our search for the origin of the Ipiutak people. A peculiar motif in their carved objects, which has not been uncovered anywhere else in America, is a spiral made of two elements carved in the round, as illustrated on page 152. Such a motif does occur, in relief, on carvings of the historic Ainu people of Japan and among the Amur River tribes of northeastern Asia. Furthermore, the exceptionally fine flint tools of Ipiutak appear to be more closely related to Neolithic flint work in northeastern Asia than to the coarser work of northern North America.

These somewhat intangible clues allow us to piece together tentatively a probable story. A Neolithic people of eastern Asia moved northward along the Asiatic coast, crossed over to the American shores, perhaps at Bering Strait, and settled the American Arctic coast at least as far north as Point Hope. This was during some period before the coming of the Old Bering Sea Eskimos, in terms of our own calendar probably before the birth of Christ. Apparently the people did not spread along the American coast but remained together in a single colony, since among all the thousands of implements dug up from sources of ancient sites along this coast there are no examples of Ipiutak culture. Archaeologists will, of course, be on the lookout for them.

We have yet to explain the gap between the Ipiutak culture and that of the most ancient Eskimos. Will other linking sites be found, or will this settlement remain as the only trace left on the face of the earth by this mysterious people? This can be answered only through further exploration, both in the inland regions of northwest Alaska and in that vast area of eastern Asia north of the Amur River and east of Lake Baikal, where unfortunately little is shown of the early history of Arctic penetration.

Fifty skeletons from Ipiutak, now under study, will reveal whether these people were related physically to the Eskimos and whether they were by any chance the ancestors of the present people of Tigara.

The Way of a Fossil Hunter

A veteran of twenty-eight expeditions, Walter Granger has served the American Museum at home and abroad for more than half a century. His picturesque rise from country boy to a scientist of international fame lends color to an expanding era

By D. R. BARTON

On a dark night in the spring of 1923, Walter Granger was the only "foreign devil" inhabiting an obscure little village in the interior of China, called Yen Ching Kou. His residence was a temple of the Buddhist type—the most imposing edifice in town—for which he paid the fabulous rent of $1.50 a month, his landlords being the T'ans, a local family whose members had erected the temple as a dwelling place for the shades of their ancestors. On this particular night a certain Chinese army was passing through Yen Ching Kou in full retreat, and another army, also Chinese, was expected to arrive on the morrow in full pursuit.

Granger looked down from the temple gallery on the curious sight of shadowy semi-uniformed troops slopping along barefoot in the mud while their matériel was being transported by miserable coolies, whom they drove along at bayonet point. The soldiers carried paper umbrellas — often a standard piece of military equipment in China—, but Granger was well aware that they were on the lookout for more substantial shelter against the threatening rain. And he knew that his temple was the most tempting billeting prospect in the neighborhood. The banners of the United States of America and of the American Museum of Natural History hung over the main entrance, but in such circumstances Granger had reason to doubt the efficiency of these symbols. Accordingly, he put his trust in the resourcefulness of his assistant, Jim Wang.

Jim, a remarkable Chinaman, had prepped at Highland Military Academy in Worcester, Massachusetts, and though it cannot be recorded that he went on to Harvard, he was certainly well-equipped to serve as Granger's official interpreter. The situation, however, frequently proved beyond the scope of linguistics, and Jim based his strategy on the fact that foreign devils were at that time still held in considerable awe. Each time the short-tempered, footsore troopers battered their rifle butts against the door, Jim would summon Granger, open the door a little way, and subject his master to the full glare of a flashlight. Behold the foreign devil in the flesh! The soldiers reluctantly sought quarters elsewhere.

Blackstone Photo

WALTER GRANGER

It was necessary for Granger to display himself thus several times during the evening despite a heartfelt preference for the shrouded seclusion within, among the departed spirits of the T'an family. Moreover, he had to spend most of the succeeding days on the temple doorstep advertising his presence to the pursuing army. There was no flashlight this time, but it was still a very trying experience. Not that Doctor Granger is a timid man. Far from it. But he is a master of self-effacement and nothing is more repugnant to his nature than to be spotlighted for public exhibition. In fact, he would never again consent to so protracted an exposure to the limelight save in some equally dire emergency.

It is just possible that his attitude toward illumination was acquired in uptown New York some 30-odd years before when duty obliged him to clean a series of kerosene street lamps in the dead of winter. These lamps were mounted along a boardwalk leading from the steam-driven elevated trains of that era to the single building which then sheltered the exhibition halls of the American Museum. To polish globes and trim wicks was a strange undertaking for a boy who later became the first paleontologist to enter the last great unknown fossil area in the world and wrest tons of scientific treasures from its ancient sediments. Yet though he is now one of the most renowned collectors of our time, responsible in whole or in part for a vast array of specimens ranging from a 66-foot Brontosaurus to Ectoconus, a 30-inch product of the very earliest age of mammals, he can recall no ordeal more arduous than this humble job of lamp-cleaning.

Early days

On the thirtieth day of September in the year 1890, a telegram was delivered to the Granger homestead in Rutland, Vermont. It was an important message from father to son, stating that, if he so desired, young Walter could find employment next day at the American Museum of Natural History in New York. Mrs. Granger promptly hitched up the team and drove out to the farm where her son was working and where he had spent much of his childhood. He was then approaching his eighteenth birthday. That night he boarded the New York train and at 9:00 the next morning first laid eyes on the institution he has since served with unusual distinction for more than 50 years.

Walter had long been interested in museum work, and his father, an insurance representative, had happened to drop in on Mr. Jenness Richardson, a former Rutland boy, who was chief taxidermist at the Museum and who informed him of the vacancy.

Of course, Walter was thoroughly familiar with the birds and mammals of his native Vermont and, like most rural boys of those days, he was accustomed to the uses of rod and gun. But he had to start from scratch in the taxidermy business, as he knew next to nothing about the preservation of specimens. Indeed, he had to start from less than scratch, for officially he was on the staff of Mr. Wallace, the superintendent. Everyone understood his ambitions, but he felt obligated to do something in return for the plutocratic salary of $20.00 a month which was drawn from Wallace's budget. It was for this reason that he passed a good many bone-chilling half-days that winter cleaning the kerosene lamps.

Presently, however, he was devoting his full time to the art of preparing birds, mammals, and reptiles. Looking back over the years, Doctor Granger deprecates his taxidermy and says that he never had "the touch" to become a true professional. Nevertheless, the experience furnished an excellent earn-as-you-learn course in zoological anatomy, a subject into which he delved more deeply as time went on. He shared living quarters with a young medical student who was interested in dissection and in whose company Granger enlarged his knowledge of the innards of the animal kingdom, not to mention their bones.

All this suited him well enough, but what he actually wanted was to get out in the field. A youthful wanderlust had first stimulated Walter's ambition to come to the Museum and when, after four years' time, opportunity at last presented itself he was not sorry to part company with the taxidermists. Though he has since lived in many places far from the refinements of civilization, never has he encountered anything quite so malodorous as some of the ripe cadavers the old New York Zoo delivered at the door of the wooden shed that sheltered the Preparations Department of that day.

Granger's first trip came in 1894 when he was dispatched by the combined Department of Birds and Mammals to collect specimens of living fauna around the paleontologists' field camp in the Big Badlands of western South Dakota. He wanted very much to go again the next summer, but funds were not available to send him on a full-time trip, and he had to make a compromise arrangement whereby he spent half his time collecting living forms and the other half exhuming their extinct ancestors. In this way he soon developed a profound interest in fossils generally and vertebrate paleontology in particular.

A career begins

It is an extraordinary thing how many scientific careers have been influenced by Dr. Frank M. Chapman.* And it is noteworthy that Doctor Granger, ranking second only to Chapman in years of Museum service, should also credit the Bird Curator with having determined in some measure the course of his life.

Soon after Walter arrived at the Museum, Chapman took a friendly interest in him and gave him many pointers on collecting, which he found useful on his first two trips. When he returned from the second of these, Walter had a long talk with his mentor. Chapman told him that if he was really hipped on getting in as much exploration work as possible, then perhaps bone-digging would prove his best bet. Accordingly, Granger transferred to the Paleontology Department, which had been in existence only three years and whose field work was then under Doctor J. L. Wortman. The latter set him to work at once, on the earn-as-you-learn basis, enlarging his knowledge of the sciences of geology and general zoology in preparation for life as a paleontologist.

Granger attributes to Doctor Wortman a large responsibility for his success. Instead of poring over musty volumes in some library, Walter picked up his bone-lore in long chats around the campfire in the Black Hills or among the arid buttes of Wyoming, where the paleontologists of that early day were opening up rich fossil fields. The intricate manipulative process of extracting specimens undamaged from Mother Earth cannot be learned from a pocket manual, and the ancient word-of-mouth method of instruction enabled Wortman to communicate many of those intuitive skills which are so difficult to capture and transmit through the medium of the printed page. Granger was like a young physician accompanying a veteran doctor on his calls, learning diagnostics and surgery by actual experience.

The long succession of summer expeditions which followed brought the young "digger" into contact with the last of the old West. Prairie schooners could still be seen rolling over the plains. Indians were everywhere, mostly on reservations into which Granger and his various associates often penetrated in search of the remnants of creatures who had become extinct millions of years before the red man ever set foot on the North American continent. Some of the lawlessness which characterized the era of Buffalo Bill and the James Brothers was discernible even at that late date. And one night Granger sat by the campfire apprehensively peering at the shadows around him, watchful lest horse thieves swoop down on the expedition's mounts.

Before long his steadily increasing knowledge of field work equipped him to undertake a broad study of the Eocene deposits throughout the Southwest, and he was just beginning to get his teeth into this work when there came an unexpected opportunity that made his pulse quicken.

Henry Fairfield Osborn, then President of the American Museum and a paleontologist of distinction, became tremendously interested in reports emanating from Egypt of the work his British colleagues were doing on the other side of the world. In the Fayum, excavators had accumulated an absorbing collection of strange bones wholly new to science, and Osborn resolved to lead a party into the same region in the hope of at least approximating the collection in the British Museum. Granger was at once drafted for service in the Fayum. A *passe partout* from the pen of President Theodore Roosevelt quickly won the expedition all manner of official assistance. Everywhere they went doors were flung open, and they were most courteously conducted on a tour of the pyramids as well as all the other archaeological and paleontological projects near their route.

Their own collecting grounds lay along what had once been the shore line of the Mediterranean. Although they were a hundred miles inland, there was still, literally, a taste of the sea about the place. If you were of a mind to drop a grain or two of sand on the tongue, you would instantly notice a salty tang.

These sandy wastes yielded a rare array of beasts. There was Moeritherium, who may possibly be the evolutionary grandfather of the elephants, and Arsinoitherium, a giant rhinoceros-like creature related to no other known animal. Credit goes to Granger for having discovered the first specimens of these creatures to be brought back to the United States.

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* See the present writer's "Apostle of the Birds," NATURAL HISTORY, January, 1940, p. 48; "Gambler on the Gobi," February, 1940, p. 118; "Chapin of the Congo," September, 1940, p. 123; "Birdman of the Open Sea," January, 1941, p. 54.

When the Egyptian trip ended, Granger resumed his collecting in the western part of our country, rounding out his study of the Eocene. Then in 1920 plans began to materialize for perhaps the most thoroughly organized project of scientific exploration in history. This was, of course, the celebrated Central Asiatic Expedition under Roy Chapman Andrews. Granger was anxious to go along, and Andrews was equally anxious to have him as second-in-command. For, since very little living fauna could be expected in the Gobi Desert, paleontology would undoubtedly be the most important phase of the undertaking.

One hundred and twenty-five camels transported their supplies, while eight Dodge trucks took the party far into the unknown vastness of interior Mongolia. Andrews, the leader, was almost overwhelmed by the enormous problems of organization which rose out of the welter of Asiatic political disruption, and in matters of pure science he found it necessary to rely more and more on the judgment of his second-in-command.

In fact, Andrews considers that Granger was every bit as responsible for the success of the Central Asiatic Expedition as he was himself. For the better part of ten years they worked together as a team, Granger assuming full responsibility during Andrews' rather frequent flying trips back to the States to raise funds.

The personalities in this two-man team complemented one another. Andrews was the impetuous type, the driver, his eye turned toward the horizon. Granger, on the other hand, was the conservative—careful and deliberate, with a hound's capacity to nose out a buried bone. Andrews has summed it up with characteristic vigor. "I was the accelerator," he says, "Walter was the brake."

Toward the end of the first year, the party found itself faced with a long homeward trek across completely unexplored territory. A feeling of snow was in the air, and Andrews feared the heavily laden vehicles would bog down, leaving the expedition open to possible attacks by bandits and, at best, seriously delayed. Naturally, he wanted to get back to the fringes of civilization with all possible haste. Then Granger spied a big promontory in which he felt sure that valuable material could be found. Andrews consented to stop for lunch and allow time for a rough survey. Nothing was found. The leader ordered the expedition to move on, but Granger insisted that the region looked too good to pass up. He pleaded with Andrews for one more look around. His superior's every instinct was to push on. Yet so great was his respect for Granger's judgment that he acceded to the request.

Granger went over the terrain again with that peculiarly penetrating eye which amounts to a sixth sense and is attainable only through long years of experience. He came upon a combination of geological phenomena which convinced him that a valuable bone deposit was in the offing, and sure enough it was.

Countless rare fossils were found during the next nine years, largely because Granger insisted that he could "smell" them and begged Andrews to call a halt. Thus it seems that if the leader had always had his way, half the collections of the Central Asiatic Expedition would never have seen the light. "But," Andrews declares, "if Walt had been running the whole show, we'd be digging away in the middle of the Gobi this minute."

The marvelous thing was that the teammates never had anything resembling a serious disagreement.

Of men and crows

Andrews considers Granger the best-natured man he has ever known in his life. But at two critical moments in the course of the expedition the second-in-command erupted. The first incident occurred during a siege of sandstorms, any one of which might have blown the tents halfway across Asia. To forestall any such calamity, Granger securely anchored his tent to the rear of a Dodge truck which was parked outside. As this particular sandstorm began to subside, Andrews found that the expedition water supply was a little low and he ordered one of the Chinese work boys to drive off to a nearby water hole. The Oriental leaped into the truck, threw out the clutch and ripped off. So did the top half of Granger's tent.

It seems that the customary Chinese reaction to censure is a broad grin. This so infuriated Granger when he launched into his tirade that he achieved a towering passion, the sight and sound of which has remained indelible in the memory of all witnesses.

The second outburst was the result of cumulative stresses and strains. Under the brink of an eroded cliff, Granger had made a breath-taking discovery—a cluster of bones which he knew to comprise a perfect specimen of an extremely rare aquatic rhinoceros (like everything in the unexplored Gobi, absolutely new to science). The piecemeal extraction of this precious fossil was a most delicate task which the second-in-command dared not assign to anyone else, not even to his immediate superior.

Granger accounted Andrews a good man at hunting fossils but he found it unwise to let his teammate linger long in the vicinity once a specimen was located. The leader's brusque methods of removal were enough to bring tears to Granger's eyes, and whenever a badly mangled bone showed up in camp, someone was certain to remark, "This one got the R.C.A. [Roy Chapman Andrews]."

Following the discovery of the rare rhino, Granger started out joyously each morning for the cliff, trudging uphill with his "bad lands gait"—a peculiar, paleontological roll akin to a sailor's "sea legs." Assembling his rice paper and the various shellacs and adhesives requisite to the scientific exhumation of crumbling bone, he set to work with all the tenderness of a mother handling her newborn babe. Bit by bit, he conjured the fragile parts from Nature's sandstone vise until a sizable pile of neatly sorted fragments began to accumulate on the canvas he had carefully spread out on the narrow ledge.

Enter Andrews. He starts down from the top of the cliff (Granger grimly reflecting, "Of course, it never occurred to him to come up from below.") sending a shower of loose shale pelting onto the canvas. Granger, through clenched teeth and with a strangely neuralgic smile, assures him that things are going nicely. Yes, quite nicely. When he got back to camp he would tell him all about it, but for the present he would very much like to be alone.

More digging. More meticulous prying and chiseling. The unwelcome load of shale has been painstakingly weeded out and the perfect specimen is beginning to take shape.

Enter the camp dog, who scampers across the canvas barking happily and wagging his tail. Those at the camp below heard a bull-like roar echo from the cliffs. That night neither man nor beast was safe. Hell knoweth no fury like a thwarted paleontologist.

The next morning, Granger returned to his eyrie, muttering that he had fixed things at last. The camp dog was chained to a tent pole and the second-in-command had threatened to shoot on sight the first-in-command, or any other biped that ventured to approach the cliff.

An almost complete skeleton now lay upon the canvas, every joint and knuckle in its proper place.

But Granger had left two members of the camp out of account. There came a fluttering of wings, and these two suddenly appeared—a pair of red-billed crows, beloved but insatiably acquisitive mascots of the expedition.

With a groan the paleontologist attempted to brush them aside. Manfully he concentrated on his work. Then something made him look up. One red bill was pointed skyward, and in frozen horror Granger watched the last of an irreplaceable chunk of vertebra disappearing down the gullet of a Chinese crow.

Looking back on the incident he reflects sadly, "Pets are like that. We had another mascot, a young wild ass. One night it was blowing up cold and Mackenzie Young borrowed somebody's felt-lined leather vest, shoved her forelegs through the armholes and buttoned her up. Next morning we found she had broken her tether and gone. A half-day's search with a car failed to locate her. Far as we know, there may still be a wild ass running around Mongolia wearing a leather vest."

Life in China

With the coming of winter, the thermometer plunged below zero. The howling gales that sweep unobstructed across the Gobi made further work impossible, and each autumn the expedition would repair to the main headquarters—a spacious compound in Peking, which included an acre of land and was surrounded by high walls. Here the staff could make use of complete laboratory equipment and other facilities and, for a while at least, settle down to enjoy themselves in the foreign quarter of that historic city. In some respects this well-earned rest proved more hazardous than the actual work. "Peking was my downfall," Doctor Granger mutters.

After a rigorous athletic existence in the desert, he found that autumnal indulgence in the delights of cosmopolitan life resulted in a waistline which is now, if not too ample, certainly ample enough. "Too much Chinese cooking," he says with mixed emotions, "and too many rickshaws."

But the winters were not spent in the lap of luxury. If the climate in the Gobi obviated collecting, there were more clement parts of China which might well bear investigation. Accordingly, Granger boarded a Yangtze River steamer bound for Yen Ching Kou, where he would take up residence in the ancestral temple of the T'ans. Although the region could hardly be termed unexplored, the trip was not without danger. The owners of Chinese junks, who had formerly monopolized river traffic, resented the steamers and had no compunctions about taking a few pot shots at a passing ship, particularly when they were almost capsized by her wash. The latter factor may have spoiled their aim to some extent but it did not make life aboard the steamer any more secure. A bullet was apt to crash into the dining saloon or whistle across the deck at any moment. And there were more formidable antagonists than junk men.

During most of the three seasons that Granger operated in this vicinity, the armies of various feudal lords were almost constantly skirmishing along one or both shores of the Yangtze. Once the steamer even sailed into the thick of a fair-sized battle, which Granger watched through his porthole while shaving. Whenever he transferred to smaller craft, he was always liable to an unexpected burst of rifle fire or to having his boat, equipment, and coolies confiscated by some petty military authority.

His mission in these parts was a curious one. For centuries the Chinese have been using "dragon bones" in specific compounds for particular ailments. The bones are usually fossils (it was in the drug shops that the first paleontological specimens from China were secured), and Granger had traced some of them to their original source—the digging grounds around Yen Ching Kou. Here the wholesale drug merchants purchased their wares, and Granger resolved to follow their example. It was folly to wait until the dragon bones had been brought down the river, since they are not sold in their original form but pulverized and either taken "straight" or in an alcohol tincture, or even fried in grease. Such pharmaceutical refinements undoubtedly render the bones more appetizing but scarcely enhance their value as scientific specimens.

Granger found that collecting in this area required considerable modification of the methods which he had learned in the Black Hills region and applied in Egypt and the Gobi. Instead of a "digger" he became an auction buyer and, under duress, something of a burglar. The technique was to leave the confines of his temple early in the morning and make tracks for the shafts wherein the dragon bones were being mined by the operatives of the drug merchants. He would stand at the brink of the pit, keeping a careful eye on everything that was brought to the surface. Whenever he spotted something unusual, he was prepared to outbid the drug merchants. These worthies did not relish the competition of his fancy prices. But Granger felt rather kindly toward them, although, as he expresses it, "the gratitude of the paleontologist is tempered somewhat by the abhorrent thought of all the priceless skulls and skeletons which have been ground up in the drug shops. Still, what has been eaten has been eaten and after all, nature, with her erosion of fossiliferous strata, has ground up more specimens than even the most populous race of humans could possibly have done."

Granger's scientific compunctions caused him to wince frequently at the butchery of local collecting methods and he soon felt compelled to offer a bonus for special care. But this "mass-production" fossil collecting had other drawbacks. So many excavations were being worked simultaneously that he was unable to be on hand at all of them and had to rely on bold forays into dark storage places within and beneath the diggers' homes to keep pace with the "finds." In no other country on earth would paleontologists make a practice of poking under people's beds with a flashlight, frantically seeking to salvage the thighbone of an extinct rhinoceros before it made its fateful downstream journey to the drugstore. Although circumstances frequently obliged him to barge in without permission, Doctor Granger never resorted to larceny. He paid handsomely for his bones and secured so much good will that his trespassing was not only tolerated but actually invited.

Temple workshop

When his strangely acquired collections had attained sufficient bulk, Granger retired to the gallery of his temple to "work them up." This he could do in comparative peace so long as there were no armies on the march, press-ganging his coolies into transport service. To guard against the lat-

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ter eventuality, Granger put his boys into livery. This was not done under any delusion of grandeur. Rather, it was a shrewd device in general use among the *wai jên* (foreigners: literally, "outside men") at that time, which raised the coolie above the ordinary rank and gave him the protection of his master's prestige. But sad was the fate of the lowly villager, especially if he was getting on in years. Whenever an army appeared, the young men fled, taking with them all the valuables they could carry. Only the feeble remained. These pitiful old gaffers were routed out of their hovels and forced to stagger up the rough hillside under military burdens so heavy that they often dropped dead from exhaustion and sheer terror of the gun muzzle in the small of their backs. Granger was appalled at the cheapness of human life in China (the soldiers themselves risked their lives for no more compensation than the promise of two meals of rice a day), but it was all he could do to keep his own skin and property intact and he looked on from the comparative safety of his temple, heartily agreeing with General Sherman's famous dictum.

In peaceful times, Granger's only interruptions came when the caretaker of the temple, himself a T'an, arrived each morning and evening to burn incense and kowtow to the ancestors—a ceremony which he had reserved the right to perform under the terms of the lease. Once the evening ritual had been completed, recreation was in order, and the T'an family, together with their neighbors, frequently amused themselves by watching the "outside man" eat his dinner. This annoyed Granger at first but he soon became accustomed to it and consumed his food with the Jovian gusto appropriate to his exalted position.

Meals were usually served outdoors on the gallery where Granger spent nearly all his time even in near freezing weather. Not that he had much in the way of choice. There was no central heating nor, for that matter, any fully enclosed room except the kitchen.

Granger ate or puttered with his fossils clad in a long, woolen robe. Between his feet, completely enveloped by the robe, was a charcoal brazier or fire basket by which means he managed to keep warm. Later on, when Mrs. Granger joined him, he found it necessary to secure sleeping accommodations for her at the inn next door. This had nothing to do with heating facilities (which were, if anything, worse at the inn) but was in deference to the religious prejudices of his landlords, who would not countenance a woman sleeping among the honored spirits of their forefathers. Granger conformed to these scruples most of the time. But whenever the inevitable army showed up, he moved Mrs. Granger right back into the temple. The T'ans were taking elaborate precautions for the welfare of their own kin and they quite understood.

Archetype

The state of the world in recent years has hardly been conducive to foreign exploration, and since 1930 Doctor Granger has had to confine his field work to the western badlands, where he made his first trip so many years ago. This area has not yet been exhausted by any means, and probably never will be, for Granger counts on a new crop of fossils to weather out every ten years or so.

There are also memories. Today he can be found of a winter evening comfortably ensconced in his favorite chair at the Explorers Club of which he is an ex-president and incumbent director. He can spin many a yarn of the 28 separate expeditions in which he has served during his 40-odd years of exploration on three continents, and he will always find an eager audience.

An honored man of science and a dean among American vertebrate paleontologists, he seems now an archetype of his kind—a pioneer, part of a tradition that is unhappily fast disappearing from the scene.

Doctor Granger never finished high school. Yet he is not only an acknowledged leader in his chosen science, but an abundantly informed student of all Nature. A few years ago, Middlebury College in Vermont bestowed upon him a doctorate *causa honoris* and each June he enjoys going up for commencement week at his adopted alma mater. At heart he is still a Vermont boy—a native son who, despite all his travels, likes nothing better than the autumn foliage around his boyhood haunts and a good Thanksgiving dinner at Rutland.

In an era of nostalgic veneration for horse and buggy doctors, lawyers and preachers, it is perhaps not out of place to describe him as a country naturalist—one whose wisdom, like those of his counterparts in other professions, is somehow a natural thing rather than a systematized product of cloistered scholarship.

YOUR NEW BOOKS

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SIBERIAN TRAPPER ● BIRD COURTSHIP ● EARTH SCIENCES
INDIANS ● GLASS FLOWERS ● MUSEUMS AND YOUNG PEOPLE

EARTH SCIENCES

by J. Harlan Bretz

John Wiley, $2.25

THE multitude of sciences embraced in the broad field of geology are interrelated and also are closely related with other fields of study. Just as the paleontologist must be conversant with the morphology of the recent representatives of the various animal groups with which he is concerned, so also do the students of the physical history of the earth need an understanding of the principles of meteorology and oceanography. Yet, insofar as this reviewer is aware, this book is the first to present the basic facts of these related fields in simple, relatively nontechnical language.

This book is designed primarily for use in the relatively new type of college course designed to survey science as a whole and present it as an integral part of a liberal education. As such, it is essentially a textbook; a textbook into which a great mass of important detail has been condensed. In this condensation an effort has been made to avoid both the ponderous technical terms of the average text as well as the "froth of light words" of most books of popular science. The effort was only moderately successful, but nevertheless this is a book to be recommended to the intelligent citizen anxious to learn something of the facts of physical geology and of the related sciences of meteorology and oceanography.

H. E. VOKES.

MULTIPLE HUMAN BIRTHS

by Horatio Hackett Newman

Doubleday, Doran, $2.50

FROM a long study of the phenomenon of twinning, Professor Newman has distilled this vastly entertaining and instructive book which he has filled with the answers to the questions that frequently occur to most of us, twins or not.

The fact that there are two kinds of twins—one-egg or identical, and two-egg or fraternal—is of enormous significance to scientific research in human heredity. The one-egg twins, because of their origin from a single ovum and a single sperm, share a common genetic pattern. The two-egg twins, on the contrary, are no more alike genetically than any pair of offspring from the same parents. Thus, although the former twins are genetically alike and the latter are unlike, the two members of either kind of twins normally share a similar environment. This nice arrangement permits the student of genetics to examine the relative significance of environment and heredity. Newman has found that in no case is the environment or the heredity exclusively the all-deciding factor, although one or the other may be of greater significance. In physical traits, it is generally heredity; while in personality traits the environment often plays a dominant rôle.

In the pursuit of his twin studies, Professor Newman began to encounter identical twins separated in infancy or childhood and reared apart. These cases, although difficult to find, offered an exceptional opportunity to observe the effect of differing environments on twins with identical heredity, and after a prolonged search, full of human interest, a series of 20 sets was eventually established. The report on these separated twins contributes an absorbing portion of the book.

Although *Multiple Human Births* was intended for popular reading, Professor Newman has managed to include an unexpected abundance of information without overweighting his text.

H. L. S.

WILDLIFE CONSERVATION

by Ira N. Gabrielson

Macmillan, $3.50

DOCTOR GABRIELSON has written a manual of sound conservation practice, one which will make a strong bid for acceptance as a standard text on the subject. His experience and position qualify him as an authority on Federal conservation policies. The book is well-written, comprehensive and direct. It covers a very broad field and hence cannot go into great detail, but the fundamentals are accurately defined and a basis provided for giving full consideration to the conflicting interests which enter into conservation controversy.

The author starts his discussion with an outline of the factors which control ecologies, the working of the vital forces, the part played by soil, water, vegetation, et cetera, and the influence of man who has himself become one of the major influences. The subject is systematically and logically developed and the reader is carried from the simple and obvious truths of conservation to their application in the instances where they conflict with the vested interests or the larger groups who view wildlife resources from a conditioned perspective.

Gabrielson stresses the need for active conservation groups, education of the public, research to get all the facts, and the importance of continually pressing for the establishment of constructive conservation policies. He discusses the moot problems of the waterfowl shortage, control of predatory and injurious animals, and the rights of the sportsman versus the nonshooting public. Many who read *Wildlife Conservation* will fall into the category of those who have taken sides on one or more of these issues. Regardless of which side that may be, they must concede that Gabrielson has suggested solutions which seem logical and likely to work out for the best interests of the most individuals. Some of these solutions are being carried out in practice. It is to be hoped that, in the near future, one can be assured all of the field activities in this country are living up to the constructive theories advocated by Doctor Gabrielson.

H. E. ANTHONY.

DERSU THE TRAPPER

by V. K. Arseniev, translated from the Russian by Malcolm Burr

Dutton, $3.00

DERSU THE TRAPPER is an interesting, descriptive narrative of life in the Tiagá, a forest of incredible density, in eastern Siberia. Arseniev, the author, explored the region north of Vladivostock in Ussuria in 1902, 1906, and 1907. His story is centered around a Gold trapper. The main occupation of the Golds, a branch of the Tungus tribe, is hunting and fishing and they have a wonderful reputation for their truly noble qualities. This trapper, Dersu Uzala, was not only a master woodsman of great endurance who read the forest like a book, but he was a man of great understanding and considered the welfare of both man and beast. The gradual unfolding of his character is a wonderful testimonial to these people of the Far East.

This book has definite literary, as well as scientific, worth and will prove invaluable to anyone planning a trip to the wilds of eastern Siberia. Arseniev enumerates the details of his expeditions, and no one can doubt his authority in this sphere. He was known and respected by both scientists and laymen throughout eastern Siberia. I met him some years ago in Vladivostock and found him a quiet, sympathetic fellow with a wealth of knowledge of the country and people.

Dersu, like other tribesmen of the maritime province, regarded the tiger as a god.

The picture on the cover of the book happens to be that of a tiger I skinned on the banks of the Bikin River, probably along the very trail that Arseniev and Dersu traveled before me.

I enjoyed this book, and the descriptions revived memories of my own observations of the inhabitants of this distant, forested country. Many of Arseniev's experiences were duplicated on my own trip, and I, too, can vouch for the integrity of the unspoiled native hunters.

Dersu the Trapper is written in simple, direct language, easy and pleasing to read. It is illustrated with small pen-and-ink drawings, very good and descriptive of the text. Maps show clearly the regions visited. It has an adequate glossary and an index. This valuable book will prove interesting and a pleasure to both old and young alike.

George Goodwin.

YOUTH IN MUSEUMS

- - - - - - - by Eleanor M. Moore

University of Pennsylvania Press, $2.00

TO the layman, accustomed to the stereotype so often expressed about museums as "dusty, musty places storing curios and stuffed animals but seldom visited," a book with the title *Youth in Museums* must be a surprise. This may change to astonishment if he reads the fifth and sixth chapters which give a representative picture of the modern museum—one teeming with activities for youth of varying ages. Such are found now even in museums planned for adults.

This book is the result of Miss Moore's study of the work for children in museums, made possible by funds from the Rockefeller Foundation. Following a definition of children's museums, the volume is concerned with desirable qualifications for the staff, selection of collections and methods of exhibiting the objects to aid in their interpretation. Then follows a survey of educational activities which supplement organized school work and those designed for after-school and vacation periods. The author also includes a description of methods being used for financing children's museums through the formation of auxiliaries, and completes her study with an enumeration of anticipations for the Young People's Museum of the future. As a guide to what is being done with young people in museums and possibilities for furthering this work, the volume is adequate and competently written.

Grace Fisher Ramsey.

AND STILL THE WATERS RUN

- - - - - - - - - by Angie Debo

Princeton University Press, $4.00

THE title of this book was suggested by the oft-repeated clause in Indian treaties that the agreements shall stand "as long as the waters run," which promises were worthless since Congress usually repudiated every treaty made with Indians whenever covetous white men desired their property. The subject of the book is a factual historical review of the robbery and graft of the people and officials of the State of Oklahoma by which the Five Civilized Tribes were deprived of their lands and the incomes from the same. The author's plan has been to present the facts as revealed in documents, official reports, State and Congressional enactments. Every statement is well documented. In these days, when people are shocked at the ruthless despoliation of minorities in Europe, it would be well to look at the fate of the Indian minorities in Oklahoma.

It is a familiar idea that tyranny and corruption undermine the morals of the oppressors as well as those of their victims. If anyone entertains doubt upon this point he should read this book. He will observe how judges, officials and citizens participated in despoiling orphaned and dependent Indian children and applied the same methods to negro children. Kidnaping and murder were frequent methods in intimidation and the brazen seizure of property. The jury system was futile because white citizens would not convict their fellows. Some Indian children were proved to have died of neglect while their white guardians lived on the incomes from the victims' property.

These abuses seem to have reached their maximum about 1925. Under Roosevelt's administration the crisis of the depression made grafting less and less profitable, enabling the more conscientious citizenry of Oklahoma to institute some reforms, but naturally abuses still continue. The author shows that now the Federal Government is collecting tax money from all its citizens to pay for the relief, rehabilitation and education of the Indians in Oklahoma. Perhaps the kindest way of looking at it is that Oklahoma destroyed a large part of its potential resources and now looks to the United States as a whole to pay the bill.

Clark Wissler.

COURTSHIP AND DISPLAY AMONG BIRDS

- - - - - - - - - by C. R. Stonor

Country Life Limited, London, 8/6

AMONG courtship activities, the displays of birds are almost as familiar as their songs. There has been great need for a popular book on the subject, with examples chosen from many different groups of birds. As Mr. Stonor says, general conclusions cannot be drawn from the behavior of a single species. Evolution in display has kept pace with the development of plumes, wattles, and other adornments.

The whole field, if surveyed in detail, would require many volumes of the size of this book. So here the questions of song and territory are scarcely touched upon. There is a minimum of psychology and physiology; emphasis is placed on the ways in which courting birds make the fullest use of ornamental plumage and other decorative features.

The splendid illustrations consist of 57 photographs from several continents, by a number of ornithologists. Those of the birds of paradise, the lyrebird, various species of grouse, bustards, and argus pheasant are particularly striking.

Among the birds of paradise, Mr. Stonor points out what seems to be an evolutionary development of display. Where the male bird is much the more ornamental he is likely to display actively but help little, if at all, in nesting. Among other birds where the sexes are much alike, both often join in mutual display.

Communal displays may involve a number of brilliant males, as with the ruff and certain grouse, assembling to await the duller females; or they may be conducted by several pairs indulging in mutual display, as with albatrosses and gulls. When continued after courtship is past, display seems to become a social function, or a form of recreation, as with bowerbirds and lyrebird.

The primary function of display—despite its extreme diversity among different birds—would seem to be the stimulation of both sexes toward pairing and the successful rearing of young. Mr. Stonor picks examples that illustrate the close connection between behavior and structure, as well as the progressive modification of both. He is to be warmly congratulated on his success.

James P. Chapin.

GLASS FLOWERS

- - - - - - - - by Fritz Kredel

Harcourt, Brace, $1.50

THE Ware Collection of glass flowers in the Botanical Museum at Harvard University includes thousands of models made by the Blashkas during the period from 1887 to 1936. From these models the series of sixteen on insect pollination has been chosen for reproduction in the color plates of this book. Accompanying the illustrations are explanations of the mechanism of pollination in these species. In the Introduction is a brief history of the making of these models and the way in which they were acquired by Harvard University.

J. W. T., Jr.

TEXTBOOK OF GEOLOGY, PART II; HISTORICAL GEOLOGY (Fourth Edition)

- - - - - - - - by Charles Schuchert
and Carl O. Dunbar

John Wiley, $4.00

A NEW edition of "Schuchert and Dunbar" will be recognized as an important event by all students in the field of historical geology. It is also worthy of notice here, for while strictly a textbook (and the most successful textbook in its field, as evidenced by the fact that the third edition was used by no less than 212 colleges and universities) this book is at the same time a most authoritative and readable compendium of the known facts of the history of the earth and of life upon the earth.

This is a textbook, and as such is not designed for easy popular reading, but neither is it simply an arid presentation of facts. It is the work of specialists detailing the dramatic story of the history of our world.

To the many amateur geologists and paleontologists to whom I have recommended the earlier editions of this work it will suffice to point out that it has been largely rewritten to include all the important new discoveries in the science. A new chapter has been added, explaining the methods and theories involved in reading and interpreting the record of the rocks. More than one-third of the illustrations are new and all of the paleogeographic maps have been redrawn to a new technic and are up to date.

This book, as the most useful that has as yet been published, is recommended to all who are interested in earth history.

H. E. Vokes.

A BOOK OF GARDEN FLOWERS

- - - - - - - by Margaret McKenny

Illustrated by Edith F. Johnston

Macmillan, $2.00

WITH what cheerful vitality and charm the artist has endowed the familiar garden flowers pictured in the glowing lithographs in this little volume! Each of the thirty-three color plates is worth framing. Like the previous companion volume, *A Book of Wild Flowers*, the arrangement of the plates is according to the season, beginning with the first crocus blossoming through the snow in spring, and ending with the chrysanthemum of autumn. Opposite each plate is a page of description of the flower's habit, habitat, and legend, and an illustration of the fruits or seeds of the plant. This is not a manual of cultivated flowers but a skillfully designed and most attractive presentation of some of our garden favorites. While it is written and arranged for children, adults will enjoy it, too.

J. W. Thomson, Jr.

NATURE IN CHINESE ART

- - - by Arthur de Carle Sowerby

John Day, $3.75

THE subject of this book should be of great popular interest, but Mr. Sowerby has not done justice to it. His articles in the *China Journal*, on which the book is based, were sometimes popular, sometimes fairly scientific, seldom thorough, and they have not been rewritten well enough to give the book proper accuracy or unity.

Mr. Sowerby tells us that his aim has been to determine the species of the plants and animals represented in all forms of Chinese art. He rightly objects to faulty identifications by others, but his own dogmatic corrections are sometimes petty or far-fetched.

For example, he cites one of a class of Shang bronzes which have always been described as owls, and disagrees with this attribution because of small differences in anatomy; yet he later shows a series of jades intended to represent cats which require much more imagination to guess their identity. He goes on to explain that the owl appears rarely in Chinese art for the same reason that it is absent from Chinese poetry. It has not been absent from Chinese poetry, though, and even if it has long been discarded by Chinese artists as a bird of ill-omen, we have no way of knowing if it meant that to the Shangs.

If this is not a proper scientific work, neither is it an interpretation of Chinese art. In spite of his background, Mr. Sowerby remains a zoologist with little artistic sense. The photographs show all too many tasteless bibelots introduced merely to show animals and plants. Why did he not include a few more of the bird paintings which he lists in such tedious detail? The most unique illustrations are the photos of fantastic mountain scenery, included to show that Chinese landscape artists did not have to let their imaginations run wild.

The best feature of this book are the tables by Harry Gibson, showing some of the pictographs found on Shang bronzes and oracle bones. The value of these is that besides illustrating the process by which Chinese characters developed, they picture the daily life in Shang, methods of hunting, fishing, planting, etc. Mr. Gibson's conclusions about Shang writing in the two appendices to this book sometimes tend to cloud the historical picture, however. For instance, he never gives the "proofs" for his unique convictions that the men of Shang rode as well as drove their horses and probably did not cultivate rice.

S. V. R. Cammann.

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WILDLIFE CONSERVATION

By IRA N. GABRIELSON

Director of the United States Fish and Wildlife Service

This book provides the best opportunity Americans have ever had to know about one of the greatest of our country's natural resources. It tells in simple language the basic facts and emphasizes that the various programs for the conservation of soil, water, forests and wildlife are so closely interwoven that each vitally affects one or more of the others.

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Illustrated. $3.50

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FINE SPECIMENS

By CHARLES H. COLES

Chief Photographer, American Museum of Natural History

MOST of us who are interested in natural history have collections of one kind or another: rocks, minerals, shells, Indian relics, travel mementos. If you have a camera, you also may make interesting photographs of these specimens in much the same manner as the Museum of Natural History records some of its objects. You may want to give an illustrated talk. In that case, the first step is to take good photographs of your specimens, from which lantern slides can be made. Or you may want to have the objects identified by a scientific authority without the trouble or risk of sending the objects themselves.

The first decision to make in photographing, let us say a mineral specimen, is what purpose the picture is to serve. Is it to demonstrate exactly what the specimen looks like for scientific record, or is the specimen to be "glorified" with a more artistic appeal? Let us assume that an accurate representation is the basic requirement, for on this groundwork the photographer can develop his own favorite tricks in artistry.

The scientific record

The first step in making accurate record pictures is to ensure the elimination of all background details that might detract from a clear portrayal of our mineral specimen. Shadows on the background are also an interference that must be removed.

A camera that is arranged to make photographs vertically, that is, with the lens pointing straight down, is the answer to these problems. A miniature camera may be mounted vertically by using that Jack-of-all-trades of the chemist—the ring stand. A ring stand equipped with a large metal clamp will hold the camera over the mineral in many different heights and positions. Larger cameras will require heavier stands.

After a suitable vertically-operating camera is obtained, the stage must be prepared for the specimen. A sheet of glass larger than the field covered by the camera is supported four or five inches above a sheet of white paper. Another clamp on the ring stand upright will hold the glass, or several blocks of wood may be used. On this glass the specimen is placed.

The illumination

When the specimen is illuminated, it will cast shadows on the white background. Often it is possible to arrange the lights so that the shadows fall far enough away from the specimen to lie outside the picture. If a shadow does come within the picture area, an extra lamp may be flooded onto the white background sheet to obliterate it.

As a rule, diffused light is best for small specimen photography. Daylight (not sunlight) is one of the softest and most satisfactory sources of light. Set up a white reflecting surface near the side of the specimen, away from the light source, to throw some illumination on the shadow side of the specimen.

Unless the object is reddish or brownish in color, panchromatic films offer no advantage over orthochromatic emulsions.

Focus carefully, stop the lens down as far as it will go, and make the exposure, taking care not to shake the camera. The result should be a sharp, well-outlined, shadowless photograph. Tedious painting-out of the background will be eliminated, and an accurate outline ensured.

The simplified lighting just described is best used on a subject where the outline is rather complex and where a definite light direction would only confuse the shape of the object. There are cases, however, where a sharp, directional light, such as direct sunlight or the beam from a spotlight, has definite advantages.

Suppose we have a rock specimen in which a fossil has made an impression in low relief. Soft illumination would obliterate what small differentiation there is between the imprint and the matrix.

To bring out these figures in low relief, a sharp light (one with a relatively small source) must be sent glancing along the surface of the rock face. The light may be direct sunlight or the beam from a spotlight. By tilting the rock slightly this way or that, the angle where the relief shows to best advantage may be found. The specimen may then be clamped in a ring stand at that exact angle, and when the camera is moved around in front of the rock face, all is ready to make the photograph.

Where two sides of a specimen must be shown with sharp relief, two sharp light sources are required. Direct sunlight and sunlight reflected from a mirror may be used, or two spotlights. Illuminating two surfaces of a single specimen in this way may require very careful light positioning.

With experience it will be found that it is possible to light a single specimen satisfactorily showing all its characteristics; but lighting two or more specimens in one photograph can only be accomplished by sacrificing some of the details of each. No one lighting will be correct for more than one specimen. It is best, therefore, to concentrate on one object at a time.

LETTERS

Sirs:

. . . I think the covers of Natural History the most beautiful that I've seen and its contents the most interesting of any magazine that I read.

Mary M. Perkinson.
Pawnee, Oklahoma

* * *

Sirs:

. . . The Natural History Magazine has been a source of pride and joy in our home for the past four years. We look forward with anticipation to another "Natural History" year.

Charles F. Gritzner.
Newaygo, Mich.

* * *

Sirs:

Very many thanks for your kindness in sending copies of the chart . . . I was a little apprehensive about their arrival, as some mails posted about that time were lost at sea. . . . The December issue, however, arrived safely, and I should like to congratulate you—above the monthly debt of congratulation which each issue incurs—on the great beauty of its cover design.

G. E. S. Turner.
University Museum
Oxford, England

* * *

Sirs:

May I congratulate Charles H. Coles on the Kodachrome reproduction of the Siberian tiger on the cover of the February issue of Natural History Magazine. To me it represents one of the finest cover illustrations we have had in a long time. I certainly look forward to seeing more from time to time, both on the cover and in the Magazine proper. . . .

H. C. Koenig.
New York, N. Y.

* * *

Sirs:

Included with this letter you will find a check covering my annual dues for 1941. I should like to tell you how glad I am that despite the mess Europe is in your wonderful paper still gets through to Switzerland regularly. It is one of the few bright spots left, now that traveling abroad is quite impossible. I am sure that Natural History is the most interesting and the best-presented paper of its kind—there certainly is nothing like it in Europe.

C. A. W. Guggisberg.
Berne, Switzerland.

Sirs:

. . . I praise most highly this magazine which I receive monthly. . . .

Herbert D. Fisch.
Brooklyn, N. Y.

* * *

Sirs:

I have subscribed to your magazine, I think, four years, and look forward to it above all others that come to our house . . .

Ralph S. Howe.
New Britain, Conn.

* * *

Sirs:

. . . I take this opportunity to tell you my thankfulness and deep appreciation for all the joys and satisfaction of every kind that Natural History Magazine is bringing me month after month and year after year.

I am more than thankful that I could receive all the numbers of the Magazine, so far, in spite of the European situation. I cannot imagine what it would be to have to go on without it, and I hope firmly to be able to receive it always.

There is nothing you would wish to add to this magazine, because it is simply perfect; each copy is a treasure which brings with it knowledge and pleasure. To you all, editors, writers, and illustrators who make it what it is, I wish to extend my sincere gratefulness.

(Dr.) Charles D. Chessex.
Lausanne, Switzerland

* * *

Sirs:

I have my American Museum certificate and my first copy of Natural History Magazine. I am delighted with the Magazine and sorry I did not apply for membership in the Museum long ago.

A. R. Allen.
Trinidad, Colorado

* * *

Sirs:

During the past year I have been particularly interested in the articles contributed by Martin Birnbaum. Mr. Birnbaum's brilliant mind, broad sympathies, and facile pen leave one feeling almost as though one had traveled with him, certainly wishing one could. I hope there are to be more.

Hugh Wightman.
Hartford, Conn.

Sirs:

We keep the magazines themselves intact in my office for a long time—as long as they will keep, for I find that they "walk off" and I lose about five out of every year's file. . . .

H. A. Roberts, M.D.
Derby, Conn.

* * *

Sirs:

I was greatly interested in Isabel Harper Blount's article "A Lynx in the Home" . . .

Garnett Prentis.
Baltimore, Md.

* * *

Sirs:

I was much interested in the article "World's Highest Waterfalls" in the December, 1940, number of Natural History.

During 1912, 1913, and 1914 I spent the season from June to December in half a dozen trips covering most of the mountainous region between Lake Louise and the Peace River. My primary interest was in settling the northern limits of *Ovis canadensis* [mountain sheep]. . . . This work I did in the interests of the Biological Survey, although these trips were my own personal trips. . . .

Our last trip in 1914 took us five months to reach Hudson Hope from Jasper and return. During that trip we discovered on the Murray River (which we referred to as the East Pine) a very fine waterfall about 250 feet high. No one, to our knowledge, had been into this country, except possibly Indians hunting and trapping, because of its inaccessibility and the difficulty of travel, caused by burnt over country and bad down timber. We saw no recent signs—trails, blazes, etc.—near the falls. Farther down the river we found old blazes made by Indians traveling by canoe, about 20 years old. At Hudson Hope we did not find anyone—trapper, Indian, or trader—who had ever heard of these falls, which we called Kinuseo Falls, from the Cree word for fish, as the pools in the river were full of Dolly Varden trout. The falls were very beautiful, although when we were there in October the water was low. At high water they would be exceptionally fine.

The only other person whom I know definitely to have seen the falls was Prentiss N. Gray, whose curiosity, aroused by an article which I published in *Appalachia* (Vol. XIII, No. 3), caused him to make a hurried trip through the eastern area. . . .

S. Prescott Fay.
Framingham Center, Mass.

April **NATURAL HISTORY** *1941*

Lost Empire in the Jungle • Diamonds • Roy L. Abbott

William K. Gregory • Blue Geese in April • New Guinea

OLUME XLVII. No. 4 FIFTY CENTS

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Above illustration painted by F. L. Jaques, from Bird Group of Hudson Bay Region in the American Museum of Natural History

LETTERS

SIRS:

NATURAL HISTORY merits higher praise than any individual can ever give. I look forward to each issue with intense eagerness and can hardly wait for the next copy to arrive.

This publication is truly the best magazine offered to the American public. No one can help appreciating the rich covers, exceptional photographs and drawings, and vivid, lucid articles. It not only adds much to one's happiness, but it also gives one a broader, more conclusive knowledge of the earth's life and history. I find it to be a great relief from the monotonous, depressing tales of the newspaper.

Especially liked in the February issue were "A Dinosaur Walks into the Museum" and "The Mystery of the Fig." I was particularly fascinated by the Siberian tiger on the cover.

DANIEL V. BOESE.
Tigard, Oregon

* * *

SIRS:

. . . Your publication is surely outstanding, in reading matter and in general make-up of the Magazine itself. My compliments!

I. A. MAGUIRE.
Minneapolis, Minn.

* * *

SIRS:

Readers of NATURAL HISTORY must thank you for a rich feast in the March issue: rocks, bears, cacti, birds, and fish . . .

FRANK PLACE.
New York, N. Y.

* * *

SIRS:

My fourth-grade children have both enjoyed and learned a great deal from several issues of NATURAL HISTORY which were brought to us by a child in our class.

FRANCES ROBINSON.
Memphis, Tenn.

* * *

SIRS:

. . . I should like to assure you of our appreciation of NATURAL HISTORY, which is read with interest as it arrives, by the members of our staff.

NEVILLE JONES.
The National Museum of Southern Rhodesia, Bulawayo, Southern Rhodesia

* * *

SIRS:

. . . I much appreciate having this excellently illustrated and well got-up magazine, and should like to keep my set complete, if you can please replace the missing number.

I can put up with my house being damaged, so long as my library remains intact . . .

L. J. SPENCER.
London, England

* * *

SIRS:

. . . Your publication is most excellent, and you are doing a wonderful work.

ELI ABBOTT.
Greenwood, Miss.

* * *

SIRS:

. . . I would not choose any one issue as better than the rest. They are all fine, and for the few years that remain to me, I hope never to be without NATURAL HISTORY Magazine. It gives me my most enjoyable and instructive reading.

Alhambra, Calif. GEORGE E. ANGELL.

* * *

SIRS:

. . . NATURAL HISTORY is by far the most interesting and attractive of the many magazines published, and I would not want to be without it. It helps to keep alive my interest in all phases of nature study, and is read over and over, many times. I find it a most valuable reference magazine, and treasure every number.

RICHARD F. DECKERT.
Pflueger Marine Museum
Miami, Fla.

* * *

SIRS:

Your magazine is a perennial joy and education, and it is a wonder how you manage to sustain the high standard. I look forward to it with keen interest and read every article.

Doctor Gudger's article on fishing dogs in the last number was particularly interesting, but it is not necessary to pick out one from the many. All are so good.

HENRY WYCKOFF BELKNAP.
Salem, Mass.

SIRS:

I was most interested in Isabel Harper Blount's article, "A Lynx in the Home," since I have a lynx in my home, a twelfth-floor New York City apartment . . .

New York, N. Y. MARIA LEIPER.

* * *

SIRS:

Your magazine, in my opinion, is the finest in every detail covering the field of natural history. In fact, it is beyond competition. Those responsible for its production deserve the highest praise. The reader knows that it is authentic, and that is a great satisfaction. I do not have words at my command to express my full appreciation.

Allentown, Pa. A. J. KOPP.

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Sirs:

Having recently returned from the Island of Formosa, whose aborigines I had a good opportunity to observe, I offer a few photographs which may be of interest to readers of Natural History Magazine.

Four of the photographs illustrate the so-called "pestle-chant," practiced by the women of one of the tribes on the shores of Lake Jitsugetsutan, a body of water 2400 feet above sea level, often referred to as "Dragon Lake." The women have discovered that the wooden pestles they use for pounding their millet give hollow, musical sounds when tapped upon a large flat stone. The tones vary according to the size of the particular pestle. Thus, when different-sized pestles are tapped intermittently and rhythmically upon the flat rock, a weird melody is produced. This is accompanied by melodious chanting of the women in unison.

Two other photographs show a native design carved in wood exhibiting a stylized snake motif, and a pair of carved totems typical of the work of aboriginal tribes.

The tatooing designs of the natives of Formosa, shown in the remaining two photographs, are especially interesting. The "pussy-cat" mustache tatooed on the face of the woman is a characteristic symbol used by the ex-head-hunter tribes of Formosa to indicate that a woman is married. The tatooed mark on the chin of the man tells the world that he has captured at least one enemy head, so that we might say it is a sign that he has "gotten ahead in the world." Note that he now wears a semi-military uniform, which is supplied by the Japanese to all the male ex-head-hunters for use at all times, even in the field regardless of the intense heat of tropical Formosa. The women too are dressed by the Japanese in cotton kimonos, which are symbolic of a movement that will rob another one of the few remaining native groups of the world of their own traditions and culture.

Harrison Forman.

Port Washington, N. Y.

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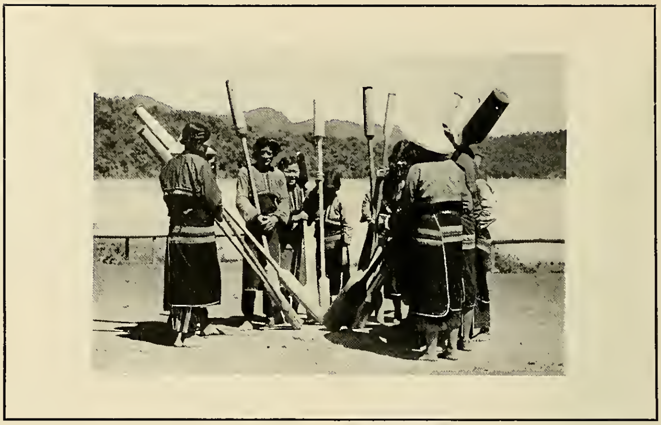
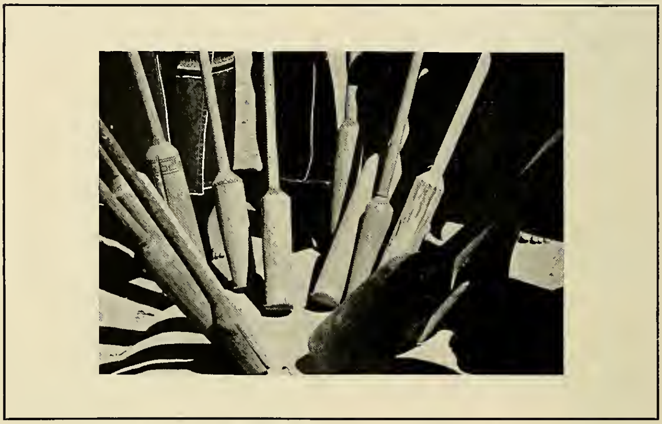
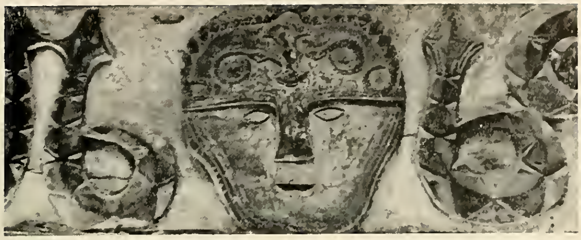
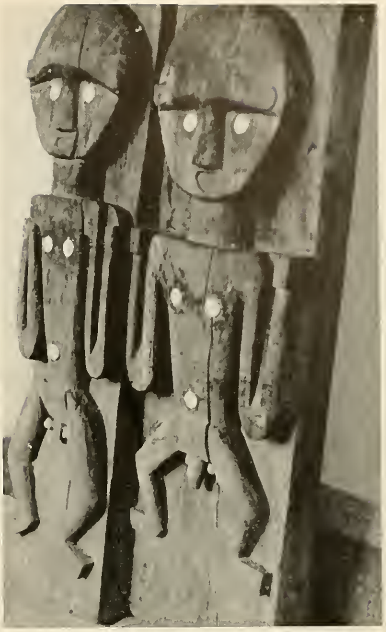




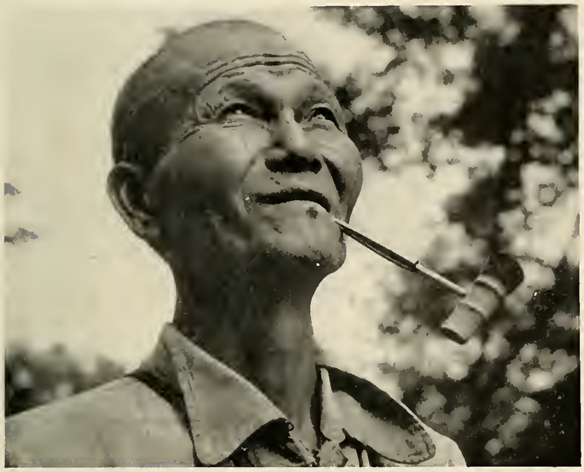
TOOLS MAKE MUSIC in Formosa when the women pound out their "pestle-chant"



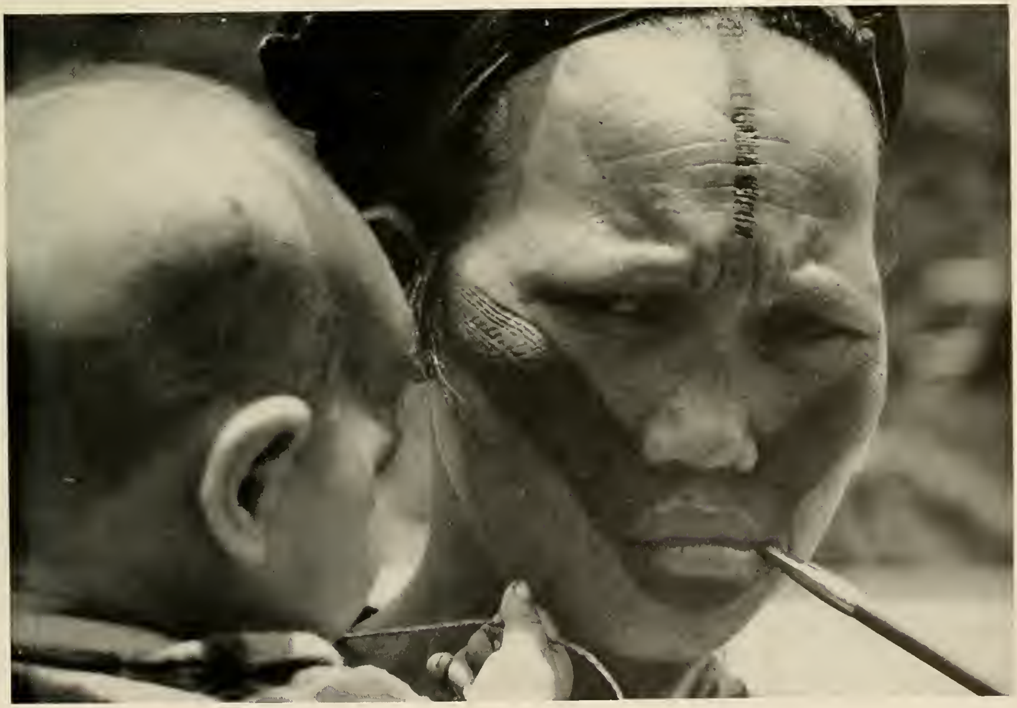
A STYLIZED SNAKE MOTIF in the wood carving art of Formosa



CARVED TOTEMS typical of the work of the aboriginal tribes



THE TATTOOED CHIN of the man above means he has taken a head. The woman's "pussy-cat" mustache is a sign she is married



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NATURAL HISTORY

The Magazine of the American Museum of Natural History

Frederick Trubee Davison, President · Roy Chapman Andrews, Sc.D., Director

VOLUME XLVII—No. 4 ★ ★ ★ ★ ★ ★ ★ APRIL, 1941

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You will find Natural History Magazine indexed in *Readers' Guide to Periodical Literature* in your library

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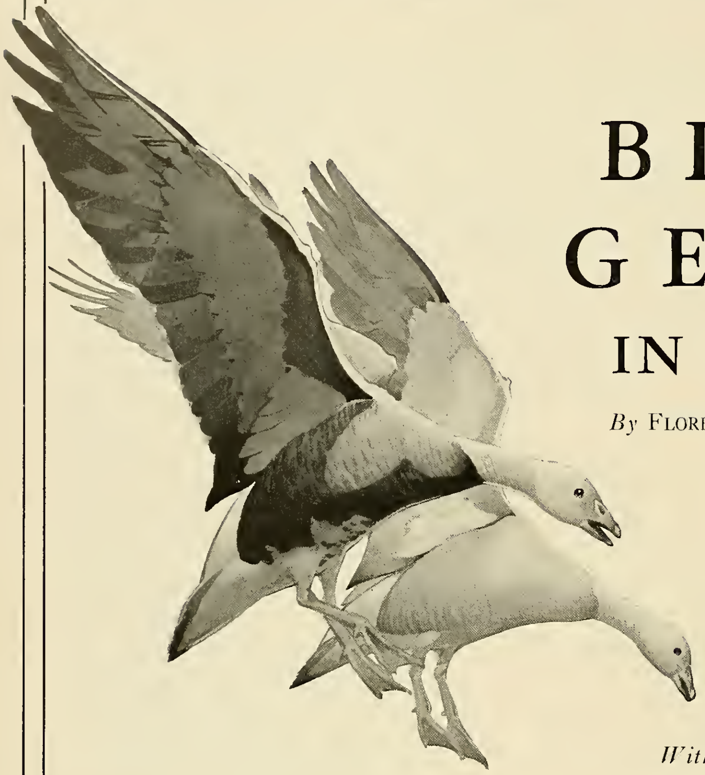
BLUE GEESE
IN APRIL

By Florence Page Jaques



With Illustrations
By Francis Lee Jaques

Partners in Flight: blue goose and snow goose

Adventure rides at your side when you follow the Minnesota flyways into a world of wings to see a living snowstorm break the spell of winter

April—but its transparent air was not springlike. As a matter of fact it was growing more and more bracing, to say the least. Clouds prowled toward us until the sun gave up its dominance and disappeared. The country went back into wintertime.

I had been enthusiastic when Lee suggested this trip to Lake Traverse, along the border line between Minnesota and South Dakota, so that he could make sketches of the blue and snow geese on their northern migration. But I had pictured balmy weather. I saw myself floating in a canoe, sheltered by green leaves, one hand trailing in the water while the other lazily scrawled a few notes. Or perhaps lying full length on a heaped hay wagon (Mr. Breckinridge had taken pictures of the geese in that way), slowly moving through fields where the birds were feeding. All my idea had been languorously colored with sun and greenness.

Now these fields were a sullen brown; and remnants of snowdrifts lingered along the ditches. The land became very flat, with scribbles of trees faint against the horizons, and the great skies I remembered as typical of Minnesota looked stormier every moment. Farmhouses wide apart, misshapen strawstacks, water standing in fields—all gave a melancholy imprint to the landscape.

"I wouldn't be surprised if there would be a heavy snow," Lee said expectantly.

But then, in the small ponds scattered at random, we began to see ducks, and that sight always lifts our spirits. Pintails came down into a cornfield. I often think my favorite duck is the pintail, with its slender, aristocratic grace, its immaculate gray and black, the snowy stripe up its neck like a Beau Brummell stock, and the tail spike which makes it so delightfully easy to identify. (At least, I always think the pintail is my favorite until I see cocky black-and-white scaups bobbing, or a little ruddy with its ridiculous fan of a tail, or a powerful canvasback coming down fast, or the brilliance of a wood duck flashing by.)

At two o'clock we reached Wheaton and engaged a room at the small hotel. Then we sped out to Traverse. This large lake, about 20 miles long, has as its northern end a wide marsh which is approved highly by wild fowl.

We took a sandy road leading across its bleak expanse to the South Dakota hills on the other side.

Cold clouds blew past us, but except for them the refuge seemed completely deserted. We discovered a few scaup ducks, chunky and alert, in a silvered curve of river. Around another bend swam six mergansers, whose wild crests always make me think of them as the savage chieftains of the duck tribe. But there was nothing flying in all the great expanse of ice-gray air.

After crossing the marsh we stopped on the rampart of the western hills. We left the car to scan the marsh with our field glasses. Down the lake there was no open water; it was frozen white, very discouraging for birding. Lee began to climb a cut-bank.

I looked at the desolate expanse. Where were all the gay bird songs I had hoped to hear? As I retreated to the car, seeking harbor from the fierce wind, I saw a string of birds high in the air over a southwest hill. Was it?—they didn't fly like ducks—Yes! They were in a wavy line, they *were* our "wavies!"

"Lee!" I called wildly. "Geese! Geese!" What staggering pride I felt in finding them first and how elated I was to see blue geese once more.

Their long journey

For blue geese are the most dramatic birds imaginable. For a long time they were an almost complete mystery to ornithologists, since they stayed close together and were extremely aloof to the rest of the world, though quite sociable among themselves. They kept their breeding grounds secret, and on their migrations they flew so high and so far that it was difficult to trace them. Only in the last few years was their breeding place discovered—a remote and isolated spot above the Arctic Circle on Baffin Island—, and that discovery is a story in itself.

The blue geese stay there and in nearby places during the short summer, and in the fall they move south to James Bay, where they meet the snow geese, who mingle with them on migrations. From there the geese buoyantly make a nonstop swoop, so high in the air that they are rarely seen, down to the coast of Louisiana. Here the blue geese almost all flock together in the marshes west of New Orleans, while the beautiful snow geese are much more widely distributed. Lee and I had spent several weeks out in the Rainey Sanctuary, on a very small island in the middle of a marsh 30 miles wide and hundreds of miles long, watching the geese fly by and seeing them gather on the marsh flats.

Now we had encountered them again.

Lee with his field glasses found another flock far to the north, and we started out to discover where they were lighting in. Rain began to fall. We took the small roads which clung to the marsh most closely and slithered along, stopping for glimpses of ducks flying. A burrowing owl stood on his vigorous legs on the top of a fence post and looked at us with a dire severity much too large for him. Finally Lee caught a glimpse of geese lighting down.

"There they are," he said. "Now they're coming for the night."

Small flocks began to whirl in. Though it was still raining, we could see black silhouettes floating down from the heights they had attained, their sudden sideslips and then the swift descent through the mist to sanctuary. We were too absorbed to get hungry until it was too dark to see.

Back at our hotel we congratulated ourselves on having engaged our room early, for it was a good little hotel and evidently well known to traveling salesmen. As we ate a bountiful turkey dinner I was glad the proprietor did not know I had bought crackers and cheese and fruit in Minneapolis, in case the meals were too forbidding. After dinner, Lee called the game warden we had been told to see.

"He says the geese shuttle back and forth," Lee reported. "Go to the fields in early morning to feed. Usually fly back to the marsh later, back to the fields in early afternoon, and to the marsh again at sunset for the night. He's offered to take us out tomorrow morning."

That was said a trifle too casually. "How early in the morning?" I asked, looking at him sternly.

"He'll be here at five," Lee said in a very matter-of-course voice.

"That means four-thirty for me! Do you know how cold it is?"

"It may be quite warm in the morning," Lee began, and laughed in spite of himself.

Geese in the night

We went to sleep at nine. At eleven the geese awakened us. So long since I had heard geese in the night; I was delighted. Their cries sounded all about us. Geese calling in the rain,—it was like a poem. But the calling went on and on, till I became first indifferent and then discouraged.

"Great guns, I hope they aren't leaving for the north," Lee said. But before morning we were longing for them to leave for points north or south, east or west, or wherever they thought best. They bombarded the hotel with wild yelling, the whole night through. Fog thickened the rain, and I suppose they were confused by the town lights, but they were certainly relentless in their perplexity. Each bird seemed to fly straight at our particular window to give his supreme shout.

"How could I ever have thought their cries were thrilling?" I moaned to myself. I remembered snatches from a lyrical paragraph I'd written about their calling in the Louisiana marsh: ". . . to bird song what the trumpet call is to music—a gallant challenge and a desperate cry, lifting the heart, disturbing it. . . ."

"Go away!" I muttered to the roisterers. "It's all right to disturb my heart, but disturbing my sleep's a different matter."

But, "Yah-yah-yah," went the little geese, on and on.

Then Lee was shaking my shoulder and telling me to wake up. The room was black and icebound. I could hear a savage wind outside. Oh glory, who wanted to see any more geese?

Creaking down dark hotel stairs, through a gloomy lobby, we arrived on the sidewalk just as the warden drove up in his roadster. We started out through the night.

Black fields. Inky blots of trees. A marsh road. The sky shifted to a lighter gray as our car hit ruts and skittered on frosty mud. "Road's a little slick," said the warden. "Rained like the mischief last night."

Bitter cold came through the window when we opened it to listen for the geese. At a schoolhouse corner we turned to the south. A serpentine of black specks curled up against the dim Dakota hills.

"They're starting out," the warden said.

Though the sky was darkly clouded, I saw far off along the horizon a rim of clear ice-green sky. Flocks of geese began to fly up across this and expanded over us. Flock after flock poured out, hundreds of birds flouting the morning wind.

Now they began to come over lower, so for the first time we could really see the details of their sharply drawn beauty. The blue geese were a dusky blue-gray with necks and heads of white; the snow geese with them were a pure white with black wing tips. This contrast made the varying groups even more intricately lovely as they arrowed through the immensities of the Minnesota sky. The wings that carved the clouds, now faintly flushed with dawn, were more stirring than banners.

"More snow geese than I've ever seen," Lee was saying. "In Louisiana there were only a few for every hundred blues. Here at least a third of them must be snows."

"Thirty-five per cent," the warden answered. "Want to follow them? No telling where they'll feed. They choose a different spot every day."

Back along the rough road again, we followed hard after the speeding birds. We took slippery wet roads around the town and off to the east. Geese were still skimming past, so far above that we felt unsure of attaining their goal. But the warden had no uncertainty, and at last we could see where they were dropping down from the blue-green sky into the yellow fields.

Soon we were close to a spot where they had begun to feed. The number of birds in the cornfield, where grain had dropped from last fall's crop, seemed limitless. We watched them, all facing into the wind, walking along the rows of broken cornstalks, serious and preoccupied. Small flocks flew up continually to light again in advance of the compact army. More and more geese arrived.

"Lord, how I like to see them come in," the warden muttered, as a bright flock sideslipped suddenly and hurled down through the scathing wind with rigid wings.

Through the glasses I watched the bright eyes, the crinkled satin of white necks, the steps taken meticulously by coral feet. These birds were not as large as the Canada geese, but they had even more pride of bearing. And when they flew up, how easily they rose, as lightly as bubbles! No gathering of energy; they simply wafted off, so closely companioned that their wings overlapped one another.

"Well, that's all that's coming, I guess," the warden said. "Want your breakfast? You can come back afterwards and see them leave for the marsh."

But when Lee and I did come back, there was no flying. The fierce wind must have discouraged the birds, for they stubbornly stayed on the ground between the furrows. We remained as stubbornly in the car and watched them work in closer and closer till we could see every feathery ripple, every motion of their busy feeding. This was the only chance they had at grain during the year, so they made the most of it.

A living snowstorm

We amused ourselves by opening the car door to make them fly up momentarily so that we could see the whole world full of sharp-cut wings, pure white and shadowy blue. To be in a snowstorm of living birds, thousands making a dense curtain all about and above us, so that we could see nothing but patterned flight, while the ground was darkened with wing-shadows,—this was a curious bewitchment.

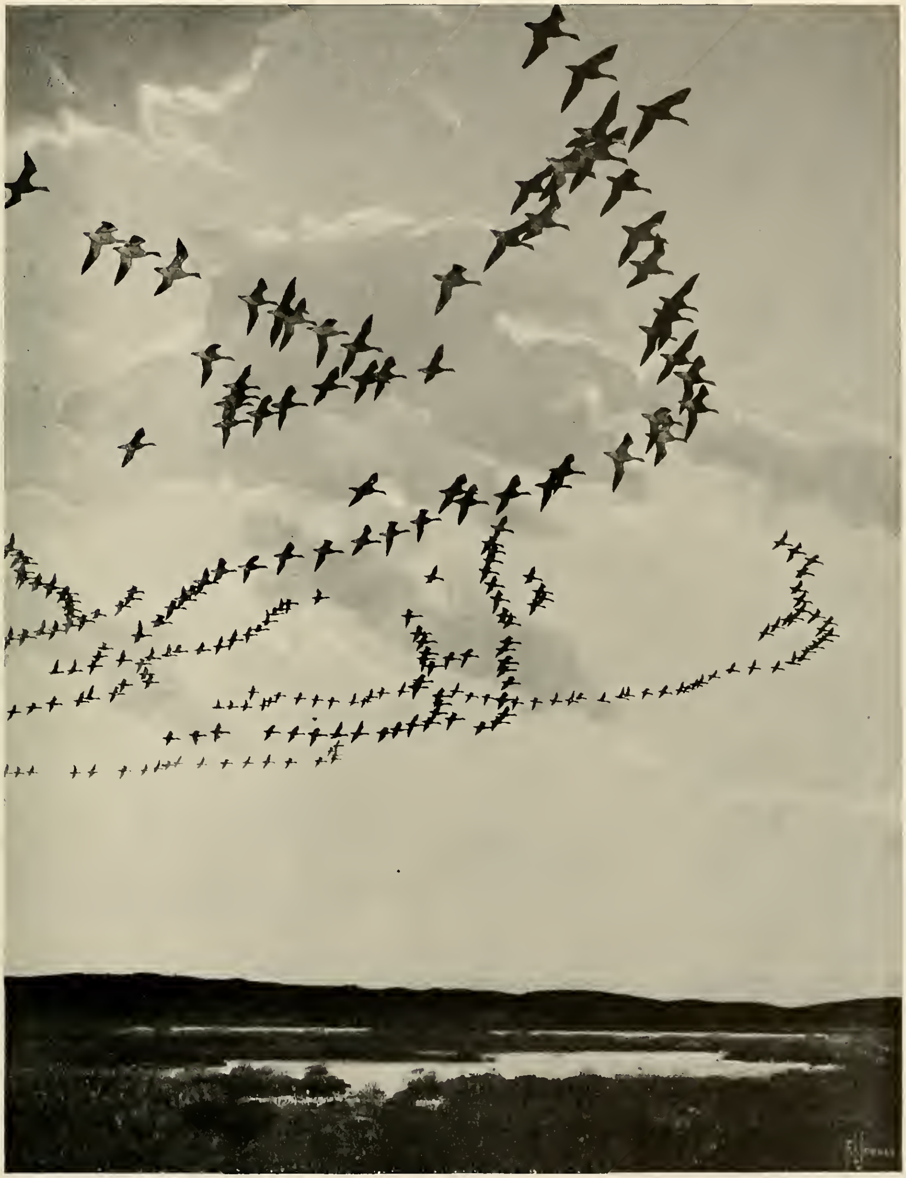
The afternoon was more arctic than the morning, clouded and colorless, with hardly a bird anywhere. We sat in the car by the marsh for a long time, but only a few pintails happened along. Not even a burrowing owl to amuse me. Where was my sunny water and my drifting canoe? There was not an inch of green in sight, not a single blade of fresh grass.

At four, to our surprise, the geese came back from the fields and hurriedly sought shelter. We watched them, but they were too far away to be as spectacular as they had been in the morning. The warden, watching, too, at the schoolhouse corner, said with relief, "Now I've put them to bed, I can go home. Boy, is this a cold day!"

"We might as well go in, too. There won't be anything else to see. We had our luck this morning."

But it was long before dinner, so we decided to drive south along Lake Traverse, even though it was frozen over. We might see something. But first we'd take the road across the marsh, just to find our mergansers in the river. They were there, and also the childish scaups, undismayed by the films of ice already stiffening across the shallows. We also found a pond extravagant with redheads, mallards, and teal, which delighted Lee.

Momentarily spots of sun lighted the windswept hills, the ruffled water, and the brown gradations of the marsh. I ventured out of the car to look at the exquisite, bronze skeletons of grasses, but the icy wind tore at my hair and skirts till its assaults drove me inside again. A bit of intense blue sky among the heavy storm clouds and the orange twigs on the low bushes near us were the only dashes of color in the whole great landscape.



From a painting by Francis Lee Jaques

WINGS ACROSS THE SKY: blue and snow geese in April flight

Suddenly we began to meet pintails. Flocks from the south kept passing us, the slim bodies streamlined in the violent gale. "The shallow ponds will all freeze solid tonight. They're coming in from those," Lee told me. My frozen discomfort and indifference began to melt. Excitement broke through like the bit of bright sky above us. I had never seen enough pintails to satisfy me. Now I was getting intimately acquainted. There came a faint flurry of snow about us, and in that mist a solitary wild swan flew past, lovely in its precarious flight.

"We'll dash back north and head off those pintails," Lee said.

The snow flurry disappeared as the swan had. A turquoise sky with gilded clouds mocked us from the east. Great flights of pintails fled past, with the late sun turning their white stocks to faint gold. I had never seen enough pintails? Now we were attended by thousand upon thousand.

"We'll never see more pintails than this," Lee exclaimed. "The warden told me there was a huge congregation in Iowa. These aren't local ducks; they're coming up from there. I've never hit a migration right on the nose like this!" He was making hasty sketches in his notebook. "There! More geese, too, beyond that line of ducks. I thought they were all in."

More and more geese came in constant lines from the clarity to the south, like a refrain repeated over and over. "Probably been blown off their course," Lee said. "Look how they have to fight against this wind."

"But Lee," I gasped at length. "More strings are coming. Look, look over that hill! As far as you can see!"

"You know what?" Lee said slowly. "This is the real blue goose migration. The ones we've seen all day were only the vanguard. This is the main flight coming in." He swept the sky with his glasses. "They look like swarms of mosquitoes over those hills."

"You mean we're being lucky enough to see them arrive from the south?" I asked incredulously.

Against a scarlet sun

Dark clouds lurched up in the north and west. A spectacular sunset flared red behind them, blurred by a snow squall. The geese flew swiftly in **V**'s and lines across the scarlet light and the black storm. And from the east and south, where the sky, like midsummer, now had clouds like floating heaps of pale carnations, geese were repeating themselves as far as we could see. The multitudinous lines filled the great sky from the horizon hills to the levels far to the north.

The sight was so tremendous and exalting that we almost wished the birds would stop coming so that we could catch our breath. Now, as it grew later, flocks came low over us. The heads of the dark birds were delicately pink, and the snow geese were transformed to shimmering rose. What ecstasy they brought us as they cut hard against the wind!

I felt I could not stay in the car. So I leaped out valiantly, field glasses in hand,—to lose my hat and have my coat blow up around my head and blind me as I ran after it. By the time I conquered one and caught the other, I had hit myself on the chin with the field glasses and was chilled to the bone. In spite of my husband's unsympathetic grins, I was glad to get back in the seat beside him.

Blue dusk was creeping over the low, violet hills. Still the geese swept by and still pintails were flying in, slender against the dark. "I can't look any more," I said exhaustedly. "It's too splendid."

As we drove back to the hotel: "Did you ever see anything as wonderful?" I said.

"No, I've never seen a huge migration come in before, and to see two at once *is* luck."

"How many geese, do you think?"

Lee is always cautious in his statements. "A hundred thousand, I'd say, and 50,000 pintails. Of course, I've seen more birds at one time," he went on reflectively. "The auklets in Bering Sea, for instance. And on the bird islands in Peru I saw nine million cormorants and pelicans. But those birds don't begin to touch our wild fowl! You, my child, have just seen one of the great sights of the world."

We rode along in silence for a while.

"But I simply can't get up and look at geese again tomorrow morning!" I said. "I've seen too many. It would be an anticlimax. Let's stop." However after several cups of strong, hot coffee I changed my mind. I couldn't miss seeing the hordes once more.

"Though not too early! It's so cold I know the geese will sleep late, too. You've always said geese were extremely wise," I begged.

But we were up and out at five. It was almost zero,—eight above, the thermometer showed. We groped our way out of the dark hotel toward our dark car. But this morning I felt insulated by excitement.

The whole earth was as black and hard as iron. We lost our way once, to our distress, for we were afraid of being too late for the uprising. But when we found our road, the only life we saw was a couple of disgruntled baldpates in the ice-fringed river. The marsh was dim, and a pale, freezing light in the east did nothing to cheer a dead world. There was not a sound to be heard when Lee stopped the car by the marsh. After a moment, a little cloud of geese rose up and then settled comfortably back into bed again. How sensible! Nothing more happened, not for ages and eons,—except that my feet turned slowly into two ice cubes.

Just as slowly the sky cleared except for tatters of cloud in the east. Much later a red sun appeared at the horizon, with snow flurries blown across it. Just then there was a second swirl of dots rising above the hill and settling back again. Then there was perfect quiet.

The sun touched the west hills and turned them cherry color, except where a few cloud shadows kept them deeply purple. Still no geese flew. We noticed how a small pond had its ripples frozen into ice, and how each reed had a delicately fashioned cup of ice curving high around its base, above the pond's surface, where the water had been blown up around it by the gale the night before.

At last the marsh itself was sunlit. How frozen it looked! And we were frozen, too. Lee didn't have enough gas to run the motor constantly, and the car was now like a frigidaire. We heard a western meadow lark bravely give its brief sweet song. It was spring in Minnesota.

Now the sun was bright. But still no sign of life came from the marsh. We would have decided that the geese had gone if we hadn't seen those two attempts at rising. I wanted to mention that I had said they wouldn't get up early, but I thought perhaps it would be better to be wise, like geese.

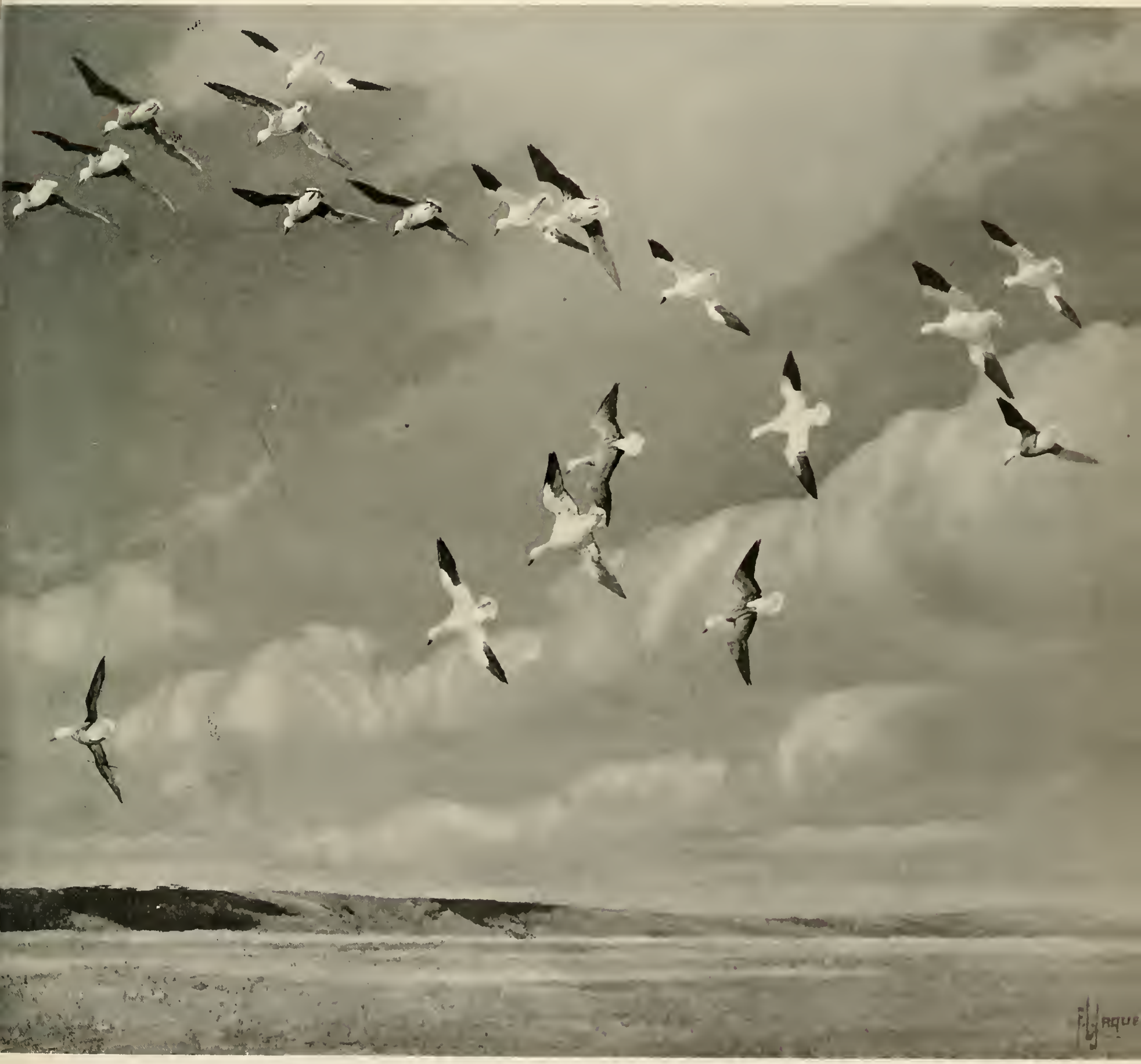
Perhaps they were escaping over the Dakota hills, instead of coming our way? But the air was as lucid as crystal; we surely would have seen them. Our spines were long icicles now. We surrendered suddenly and dashed back to Wheaton for hot cakes and sausage, hurrying our waitress frantically so that we could gallop back before the geese awoke.

But, of course, they had leaped up as soon as our backs were turned. We were just leaving town when I sighted our quarry. In the vast blue the ranks of geese were speeding east above us, line after line, **V** after **V**.

At the marsh we left the car for the open where we could see all around us. This was a more torrential flight than the evening one, for instead of being all over the sky, they came past like a river. They were directly over us, and in the clear air we could see every feather in their radiant wings. The snow

Sideslipping Down: blue geese, (blue-gray with white necks and heads) and snow geese (white with black wing tips) descending by slipping sideways to right and left

From a painting by Francis Lee Jaques



geese were diaphanous against the vivid sky; the blues a striking contrast in the sun.

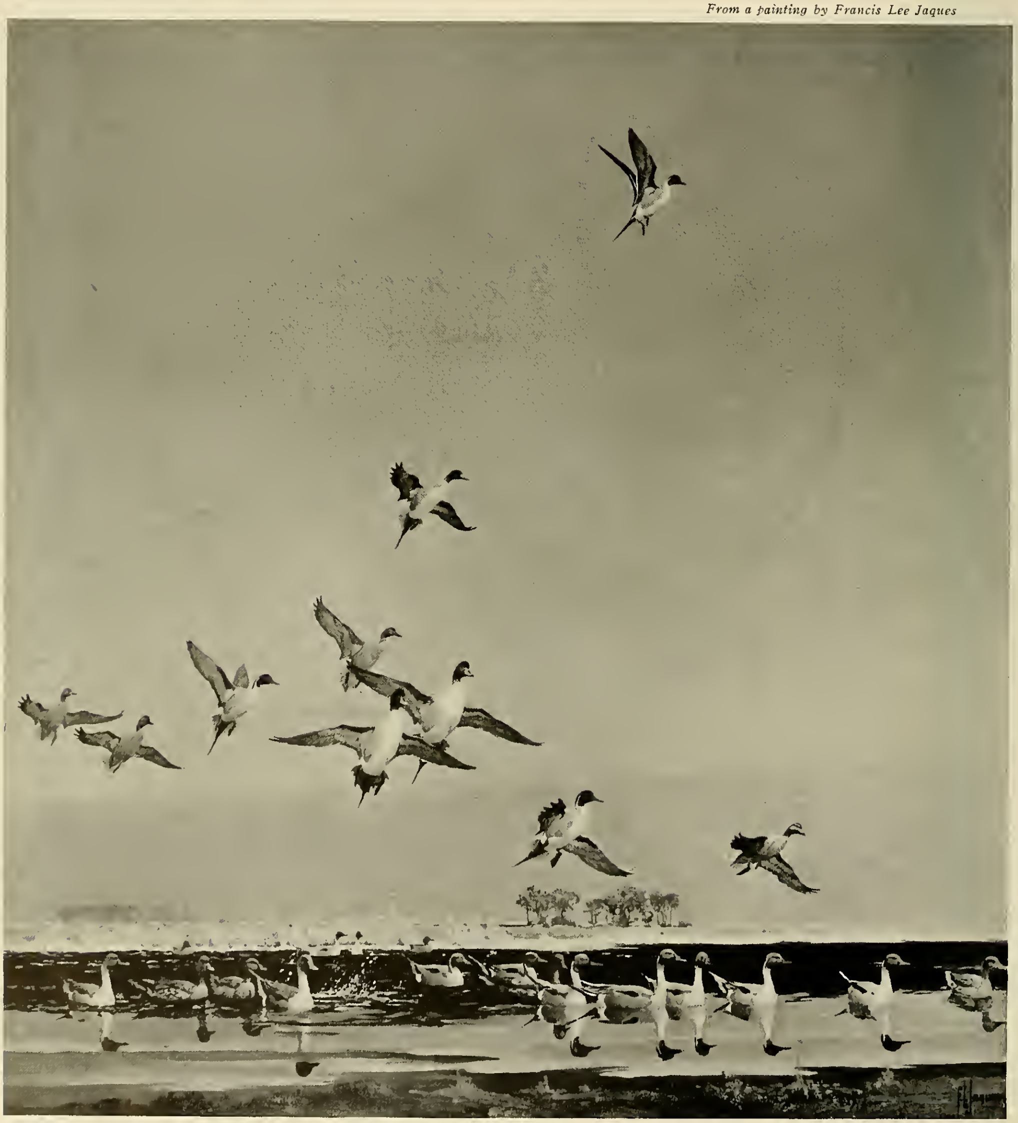
The bright array flew in every formation, **V**'s, long ribbons, and straight lines. This river in flight curved from the eastern horizon to the west, and still they came,—calling, calling. On this icy April morning my heart responded to their wild cries with inexplicable rapture.

Still they rose from the marsh like a column of smoke and flowed out into their splendid channel. Great white clouds appeared like miracles in the blue infinity, and the flying wedges darted in glory against them. This morning the motion of wings was not slow and half-drifting as yesterday's flight had been. It was very clear and hard.

The complicated tracery of wings in the air, close over us, farther and very far, the cries, the clouds, the disregarded wind,—all made an ecstatic confusion in the senses. The sky in the east was pearl-white with clouds, and the lines of geese were very high. We forgot about the earth. We were in the air, encompassed by the magic intrusion. We had lost our barriers—, and our spirits knew, for this instant, an ultimate liberation.

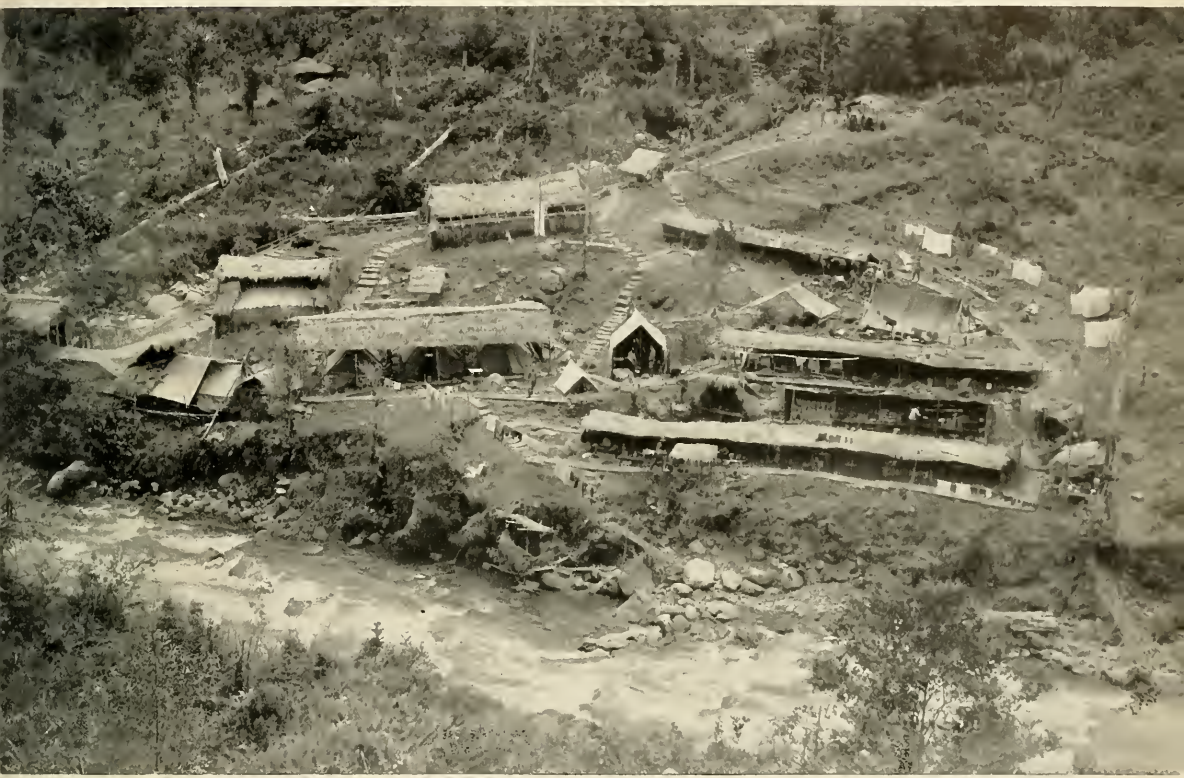
PINTAILS RISING FROM A WINDY POND

From a painting by Francis Lee Jaques



Latchkey to a Savage Tribe

By RICHARD ARCHBOLD and A. L. RAND
Research Associate, Department of Mammalogy, *Research Associate, Department of Ornithology,*
The American Museum of Natural History



Archbold Expedition photo

CAMP of the Richard Archbold Expedition in Grand Valley, a domain of Stone Age natives that was unknown until the expedition discovered it from the air. After several months at higher altitudes, members of the expedition occupied this river bank for further research and established closer contact with the natives inhabiting the valley. Though this camp stood at over 7000 feet altitude, the tropical sun was uncomfortably warm and grass shades were erected to protect the tents. The initiation ceremonies took place on the far side of the camp

The natives of a large hidden valley, who had never before seen white men, ceremoniously accept the members of an American Museum expedition and invite them to reside permanently in their realm

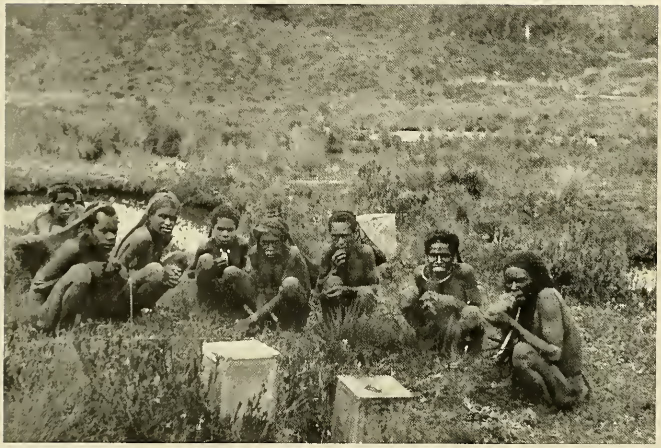
THE Pesegem and Morips live in one corner of the Grand Valley of the New Guinea Snow Mountains. Together with their neighbors, they number perhaps 60,000 persons, but the existence of their huge, heavily populated valley was unsuspected until we flew over it in 1938.

We came to them out of the sky. Our airplane *Guba* landed us at Lake Habbema in the mountains above their valley. Though this was a long day's journey above their villages and was on the edge of the alpine grassland, where ice formed each clear night, parties of these people continually passed our camp. Our relations with them were friendly but they remained few and distant so long as we stayed at these high altitudes. It was when we came to move down into their valley that we got to know them. They offered to help carry our material for us, and we had brought cowrie shells with us for trade. Though these little sea shells one-half to two inches long could be purchased in quantity on the coast, they proved to have a high value as money here. We stabilized the currency at one shell for one day's work. And for a-shell-a-man-a-day the natives carried our goods for us.

When we settled our camp near their villages, it came as a surprise that they wanted to initiate us into their tribe. We were sprinkled with the blood of the pig and given the privilege of becoming permanent residents.

They waited until the last of us reached the grassland camp. From miles around the natives came pouring in to sit around the edges of camp. They explained to us that an important ritual was to take place. Some of them were Pesegem, some Morip; both tribes seemed to take part, but we could not distinguish them. This was early in the morning, but all New Guinea is a land of *dehori* or wait-a-bit, so we were not surprised that nothing happened at once. Only lines of natives streamed over the hill, the men to sit near our camp, the women to dance on the clearing nearby.

It was chilly, as is usual at these altitudes, so the men were clustered about a little fire. Suddenly several men dashed to the fire with bundles of grass, wet from being soaked in the creek, and spread them over the fire and walked on them. We wondered at first if it might not be a fire dance. But no, evidently fires must be put out, for a one-eyed old scoundrel absent-mindedly started to light a cigarette, and though he was a man of importance, the cigarette was dashed from his hand. Some men were engaged in bringing in big slabs of wood, which had been cut with the stone adzes which these men almost universally carry over their shoulders. But now the rarer, heavier stone axes for the harder work of splitting the wood came into use. The logs were split up into firewood and kindling, and it was astounding how effectual stone axes were for this. Then several

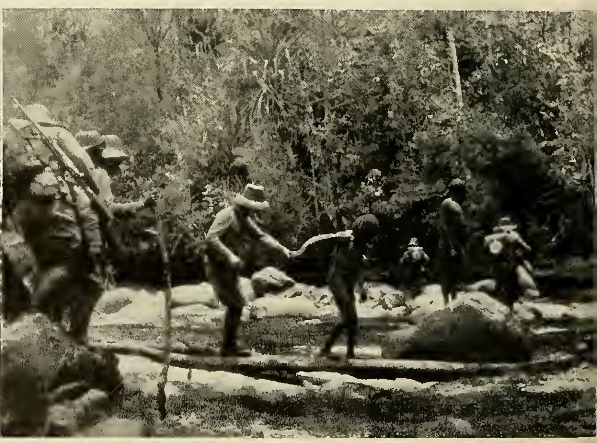


ONE COWRIE SHELL a day per man. Friendly but at first aloof, the natives offered to help the white men at this rate of payment for the task of moving their camp down into the valley from the upper heights. Their loads are five-gallon gasoline tins filled with rice. Their method of travel was a dash and a rest, then another

All photos by Archbold Expedition

(Below) IN A SNAKELIKE LINE, the expedition and its retinue move down into the grasslands of the valley

(Below) CROSSING STREAMS on swaying logs was always perilous for the boot-shod members of the expedition, but the barefoot natives were as agile as monkeys



pigs slung over men's shoulders were brought, the men singing as they came. The younger men and those of evidently lesser importance were sent away, up to the dancing.

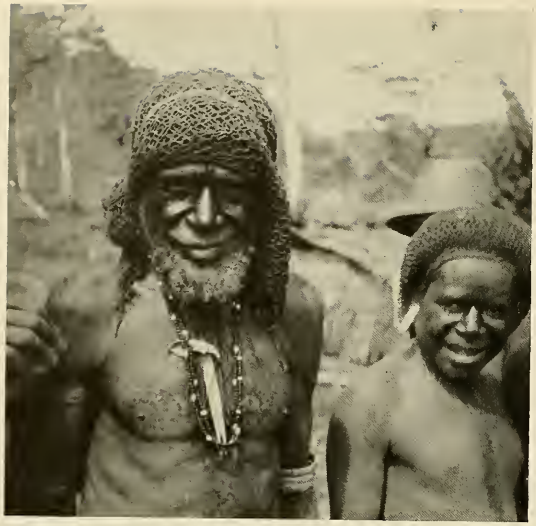
The pigs were now shot, one man holding the hind legs about shoulder high, another the snout, while a third standing about four feet away shot an arrow into the lungs. The pigs then were held in a small fire, and the natives scraped off the charred bristles and epidermis with their hands. Pits had been dug, fires were built and stones placed on them to be heated. When the stones were hot, they were put into the pit, which was lined with grass. Sweet potato tops were put in and then the pigs, which had been cut open with bamboo knives so that they lay flat. More sweet potato tops were added, then hot stones. The whole was covered with grass weighted down with stones and left to cook.

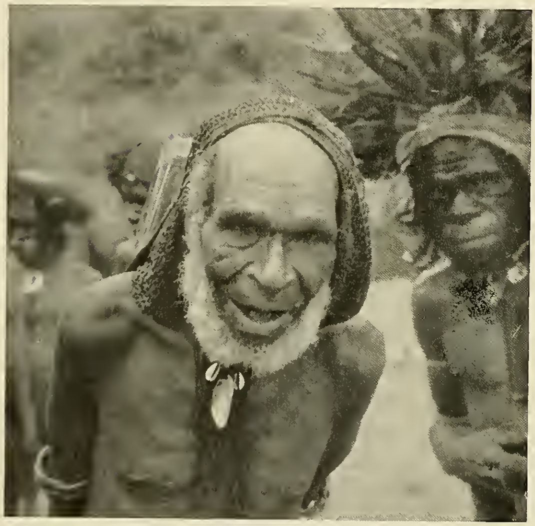
While this concoction was cooking, an old man took the pig livers, which had been roasting at another fire and were roughly cooked, and divided them into small sections with a bamboo knife. Another man took up each small piece of pig liver, touched it with a few small red feathers, and handed a portion to each of us, which we ate. This we learned definitely was a Morip ceremony. Then they led us up to the dance. There were about 250 men in one group and about 300 women in another. They had been singing and dancing most of the day, but now they were quiet. Men of importance led us around the groups of natives, apparently to inspect their fighting men and to admire the flower of their womanhood.

Then some of the old men appeared with handfuls of moss soaked with blood and water. These they held out in various directions, perhaps to points of the compass, perhaps in pertinent directions in the valley. There seemed to be some sort of invocation. Then the old men walked about the assembled men,

(Above) A View of the Valley showing scattered native settlements and fields tilled in a primitive way by some of the 60,000 inhabitants who are estimated to live in this hidden section of New Guinea

The Stone Age Natives, using only stone adzes, built crude overnight shelters like that shown at left. A Dyak brought from Borneo stands in front of this one





swinging the bloody moss so that drops spattered over the group. This finished, they turned to us and we, too, received a sprinkling of the blood. The women, who were now squatting down, removed their capes and they also received the sprinkling of blood.

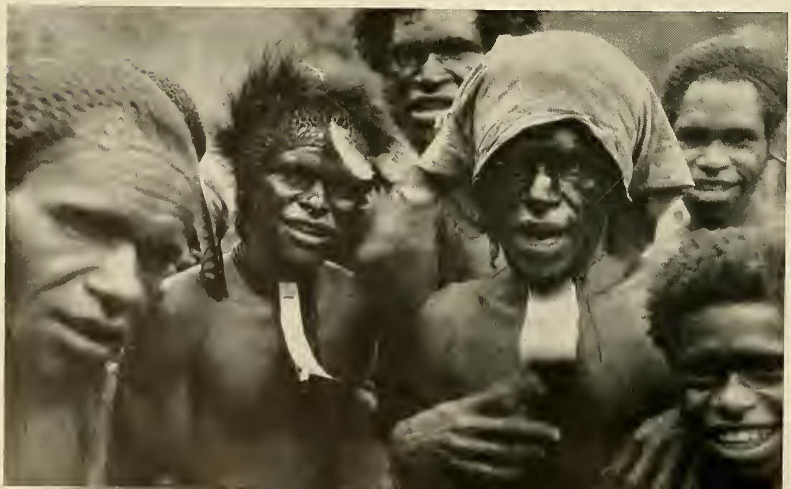
As we stood looking over them, several small pigs were brought forward. To each of us was held out a small pig and a small bamboo knife with which to cut notches from the ears of the pigs. It was then explained that when these marked pigs had grown up and had long tusks, we could return to shoot them.

The ceremony seemed over, and as nearly as we could tell they explained that now we had eaten of the pig and were eligible to remain in the valley. By now the pigs roasting in the pits were cooked. They were dug out, and we were obviously expected to join in the feast with some of the older men. This we did for form's sake and really found the pig rather good.

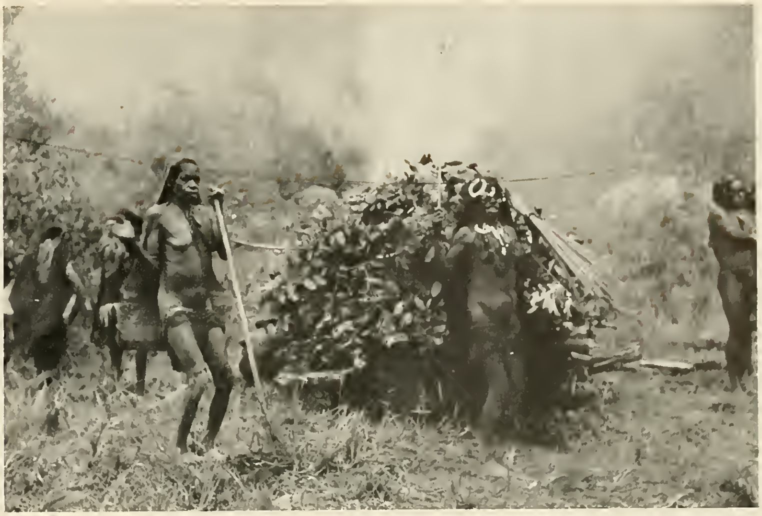
But there was one more thing. When we went back to our tents, old Gira, one of the important men of the Morip community, followed us and showed us a long strip of pandanus leaf on which there was but one shell. Now, shell is money in this country, and he pointed out all the places, about 18, on which there were no shells. The request was plain: we were to fill in the blank spaces with shells. It looked like a shakedown, but after all, if Gira came to our country, would he get off so lightly, with only a score of shells to pay?

(Left and above) Mellowed by Years, the old men were delightful to know. A fiber-cord hairnet of distinctive style was worn by many of the natives. At the neck of the man at left hang two cowrie shells, which were used as money. The other wears the lower jaw of a rat, which is not strictly an ornament, as the sharp incisor serves as a small knife

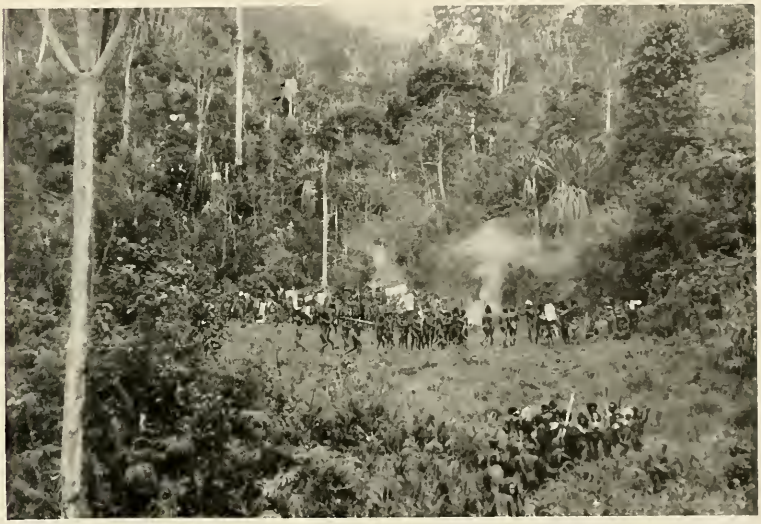
(Below, left) A Group of the less responsible element, whose ornaments are made from tin cans acquired from the expedition



(Right) WARMING UP for the initiation dance. How the loose skirts which the women wore stayed on remained a mystery. Viewed from the front, they were almost nude; but behind, a net bag hanging from the head concealed the body. None of the women came very near the camp

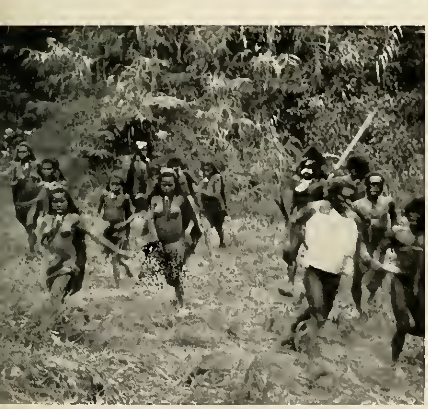


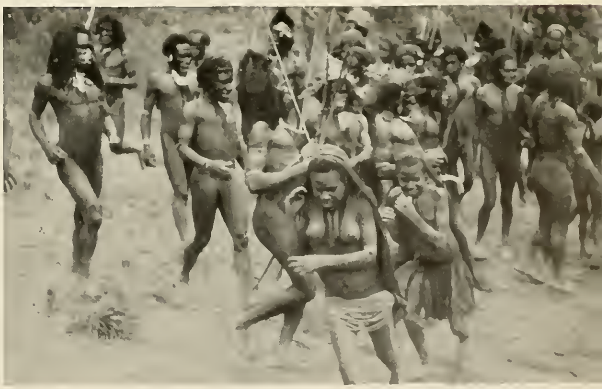
(Right) THE CEREMONY gathers momentum. A group of men in the foreground is arriving to join the women who are dancing in the clearing

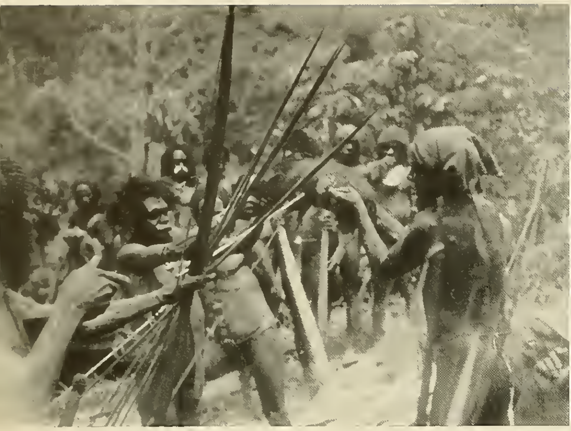


All photos by Archbold Expedition

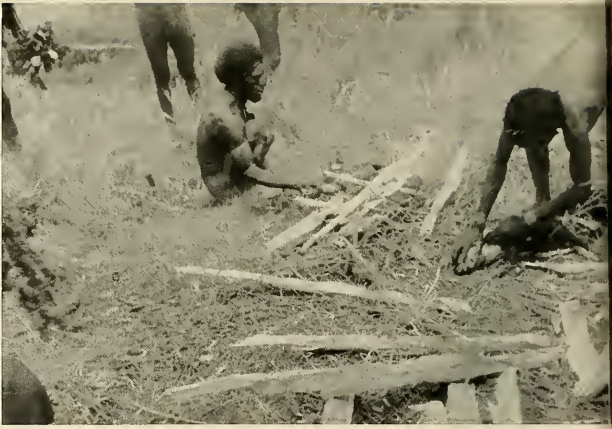
(Below) THE MEN AND WOMEN danced in separate but adjacent groups







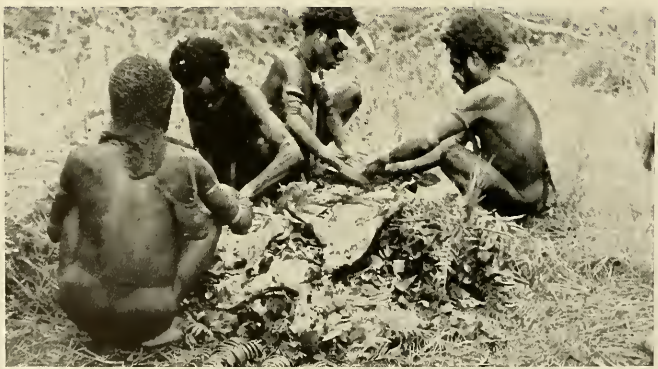
Sprinkling of the white men with the blood of the pig was one feature of the initiation ceremony. Here one of the ceremonial pigs is being shot by means of a bow and arrow. The sprinkling was done, after an invocation, by some of the old men who swung handfuls of moss soaked with blood and water

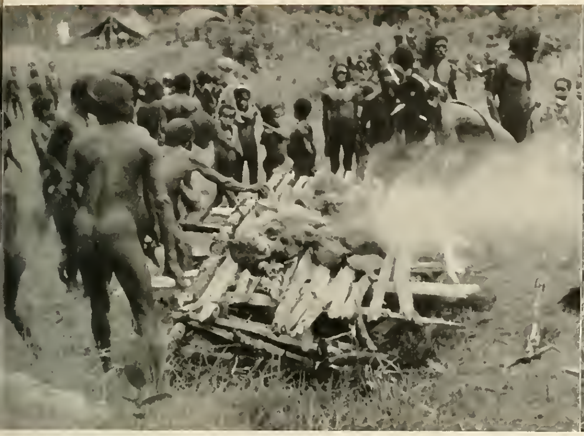


After being held in a small fire, the pigs were scraped to remove bristles and epidermis

(Below) Weighted with stones, the pigs were left to cook in the pits

(Below) On a Heap of Leaves the pigs were cut up for distribution. Afterwards a small live pig was held out to each white man, who was expected to notch the ears with a bamboo knife. This would mark them so that when the pigs grew up and had long tusks, the visitors could return to shoot them





Stones are being heated for the roasting pit, in the photograph above

Hot Stones have been put into the pit with the pigs and some sweet potato tops. The primitive oven is now being covered with grass

Gira, the man who received the "rake-off." After the feast, the hospitable natives were not loath to receive a few extra shells for their trouble

All photos by Archbold Expedition

THE FIERY FLOODS THAT FORMED THE INLAND EMPIRE

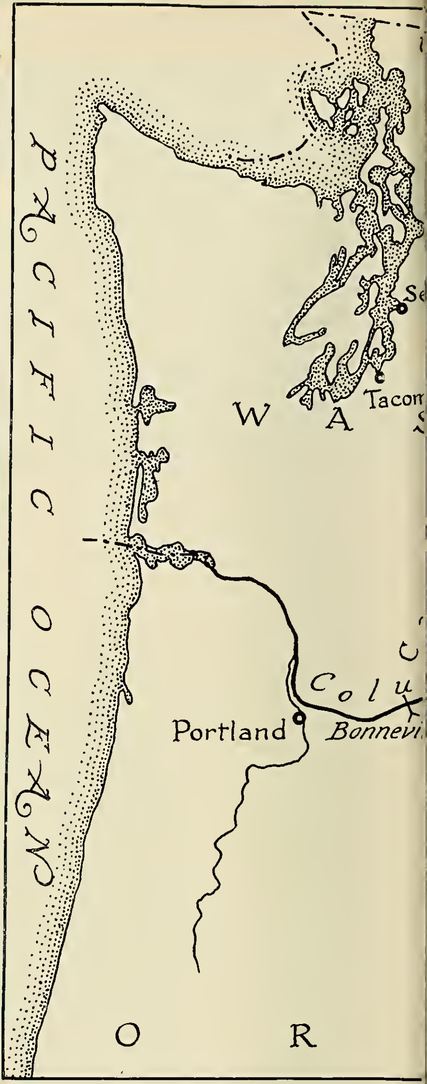
By John C. Reed

Geologist, U. S. Geological Survey

Enough molten rock to cover New England to a depth of half a mile provided the pattern for one of Nature's most gorgeous and far-flung tapestries

Over the vast country represented by the shaded area on the map at right stretch the great plateaus of the Columbia, our Northwest's "Inland Empire." Here in many a sun-drenched canyon and on many a wind-swept tableland have been enacted chapter after thrilling chapter of human history which have transformed this land of open distances in only a few short years from an unknown, apparently useless wilderness into an empire of thriving ranches, towns, and cities. Across these broad plateaus in 1805 Lewis and Clark dragged weary footsteps toward the Pacific. Today the traveler sitting at ease in the cabin of a transcontinental plane looks down on highways, railroads, and the yellow patchwork of wheat fields, as shown in the aërial photograph below. He beholds the mighty Columbia, gradually losing its struggle against man's determined efforts to halt its flow at Grand Coulee.

Photo by Courtesy of the U. S. Department of the Interior, Geological Survey



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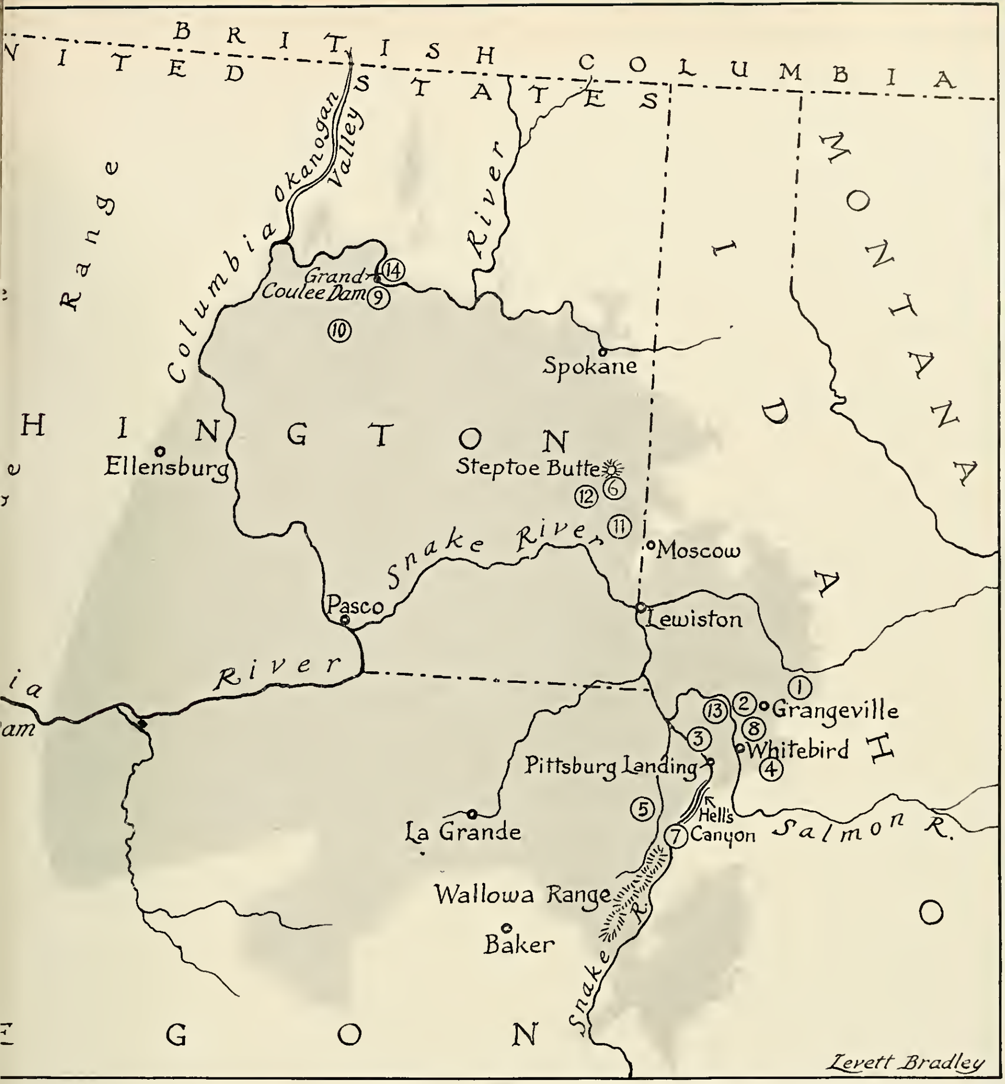
At least 35,000 cubic miles of molten rock flowed out upon the shaded area in the map above, to give the region that is now called the "Inland Empire" its distinctive character.

The numerals on the map show where the photographs illustrating this dramatic geological story were taken


BRITISH COLUMBIA
UNITED STATES
MONTANA
IDAHO
WASHINGTON
OREGON
Range
Columbia
Okanogan Valley
River
Grand Coulee Dam
Spokane
Ellensburg
Steptoe Butte
Snake River
Moscow
Pasco
Lewiston
River
Grangeville
Whitebird
Pittsburg Landing
Hell's Canyon
Salmon R.
La Grande
Wallowa Range
Baker
Snake R.
①
②
③
④
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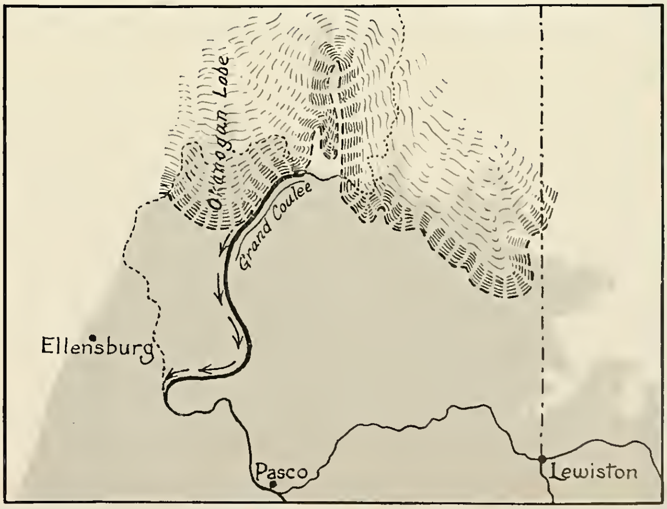
Levett Bradley

In the Ice Age when the great glacier advanced down over much of North America it forced the Columbia River to follow the course marked by the heavy line on the map at right. The dotted line represents the present course to which the river shifted when the ice retreated. East of Grand Coulee, where the ice covered the present channel of the Columbia, the drainage may have been broken temporarily. At least while the ice was melting, rivers feeding the Columbia probably flowed from many points along the face of the glacier


Okanogan Lobe
Grand Coulee
Ellensburg
Pasco
Lewiston

We need not start at the beginning of the geological story to include some of the most dramatic changes that have ever taken place in western North America and to find the reasons why the Columbia plateaus have become what is now called the "Inland Empire."

The event that forms the principal theme of this tale is the pouring out of immense lava flows. These lava flows—dozens, perhaps hundreds of them—were large enough to cover all of New England to a depth of more than half a mile. At least 35,000 cubic miles of lava! When and whence came this almost unimaginably large volume of seething, molten rock? And what has happened in the Inland Empire since the great lava floods?

2 Flow on flow of lava, interlayered at a few levels with lake deposits containing fossil leaves, are exposed where the canyon of the Salmon River cuts through Camas Prairie and Grangeville Mountain in Idaho, below

The Foundation Rock, or "basement complex," over which the Columbia River lava floods poured themselves includes a great variety of rock types. These basement rocks are exposed where rivers have cut their way down to them, as shown in the photograph at right. Here the Snake River has deeply etched the boundary between Oregon and Idaho above Pittsburg Landing, cutting deep into the older rock beneath the lava floods. Whereas the lava beds lie in layers, as seen in the distance in this photograph, the older rocks lack this horizontal layering. They are largely hard, crystalline rocks, such as granites, marbles, banded gneisses, and greenstones. The last named are at least in part themselves ancient lavas, but they are so changed that their origin is difficult to recognize.

Most of these "basement" rocks have a distinct "grain," which trends in general north and south, although there are many exceptions. Because of this, many of the water courses, probably most of the

Photo by Courtesy of the Washington National Guard

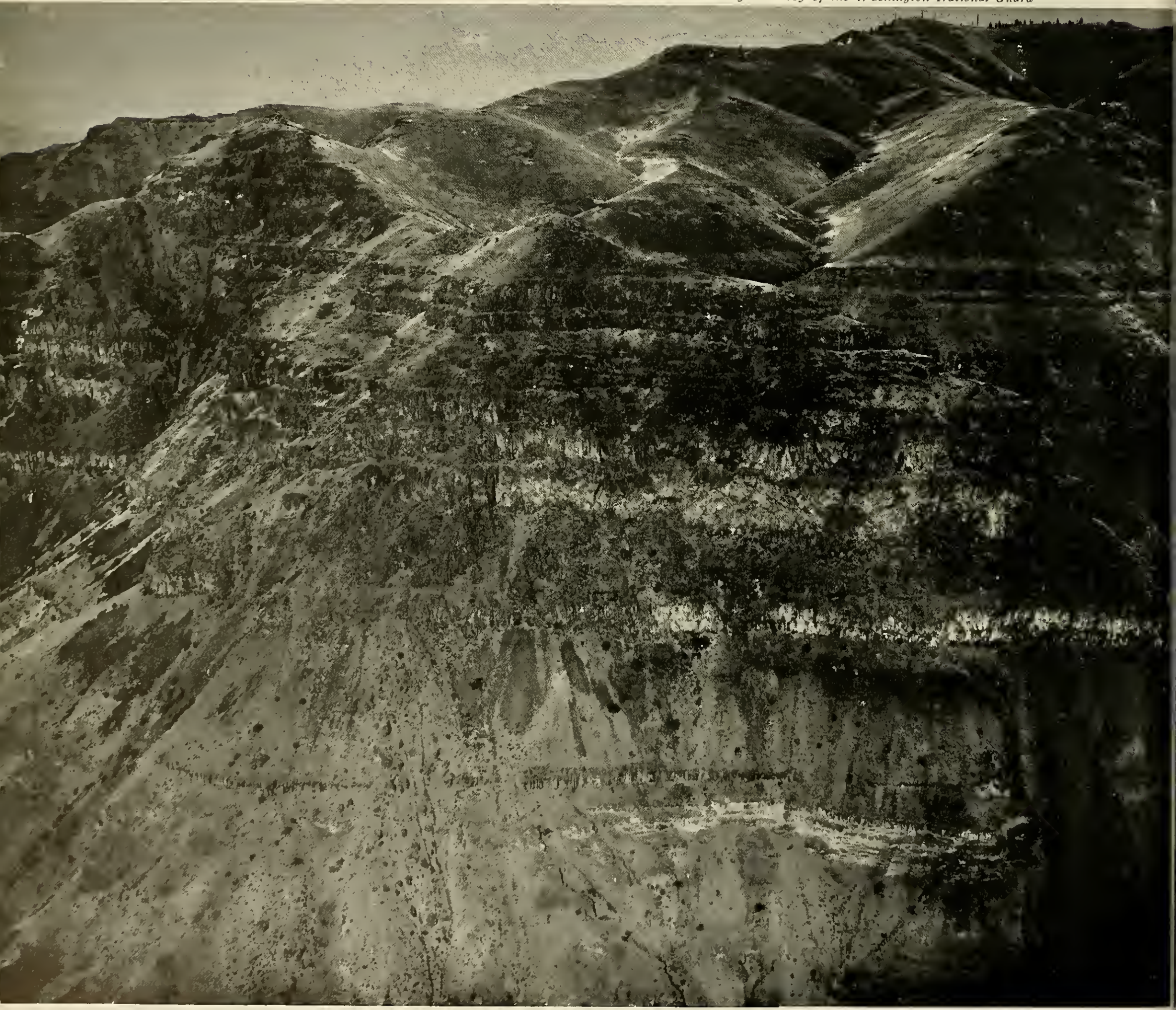


Photo by K. D. Swan reproduced by Courtesy of the U. S. Forest Service

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smaller ones at least, ran in either a northerly or southerly direction. As a result, elongate groups of hills and low mountains rose conspicuously here and there above the broad valleys. No Cascade Range then stood between the Inland Empire and the coast, and at least some of the principal rivers must have cut across the general trend of the country to carry their burden of sediment to the ancient Pacific. This was the old land surface over which the fiery lava floods spread.

Then, some 20 million years or more ago, deep-seated disturbances began to stir beneath the land that was to become the Inland Empire. Perhaps the crustal movements were urged by the fusion of large volumes of subcrustal rocks, perhaps on the contrary the fusion was caused by the crustal movements. As yet no geologist has determined satisfactorily which happened first. In fact, a fundamental question that is always coming up in such cases is, "Which comes first—the big squirt or the big squeeze?" But as the disturbances became more and more intense, the crustal rocks cracked, and through the cracks welled up the first Columbia River lavas. Not much is known about the distribution of the "feeders" of the lava flows. They are now sealed shut by the last lava that entered them and "froze" to form dikes. Numbers of these dikes can be seen where the rocks concealing them have been worn away, as in deep canyons, but most of them are buried from view beneath the lava

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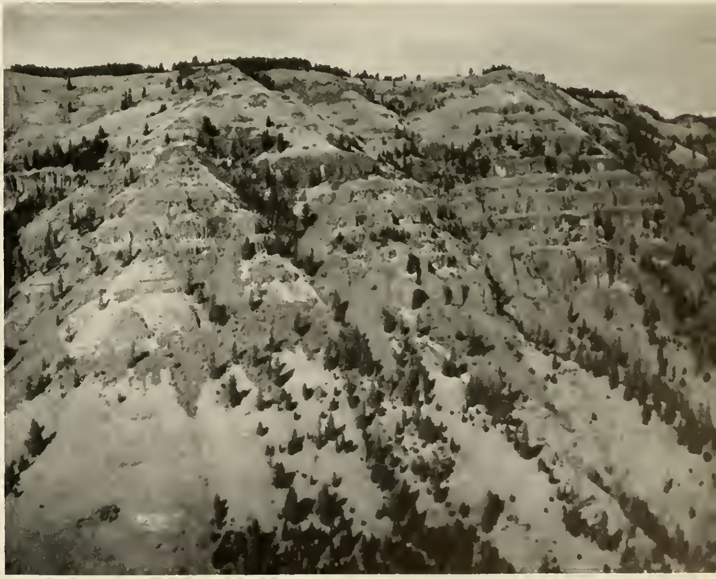
Photo by Courtesy of the Washington National Guard



As Time Went on, surge after surge of molten rock poured forth and spread far and wide over the Inland Empire. Dozens of these flows, mostly between 50 and 100 feet thick, can be counted in some canyon walls, as in the canyon of Slate Creek at right. This creek dissects a block of more than 50 flows. The top flow, though it looks fairly level in this picture, slopes downward to drop more than 4000 feet in about eight miles.

The lava must have been very liquid, for single flows commonly extended for many miles without much change in thickness. But while the fiery floods spread, their surfaces began in places to crust over as they cooled, and the juicy, rapidly-flowing material beneath continually broke up the crust and churned it along. Thus the whole mass became a jumble of broken fragments, with just enough liquid material to allow it to flow. Then the liquid solidified to bind the broken pieces and form "flow breccia," which is common in the Columbia River lavas

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Photo by Ray M. Filloon, reproduced by Courtesy of the U. S. Forest Service

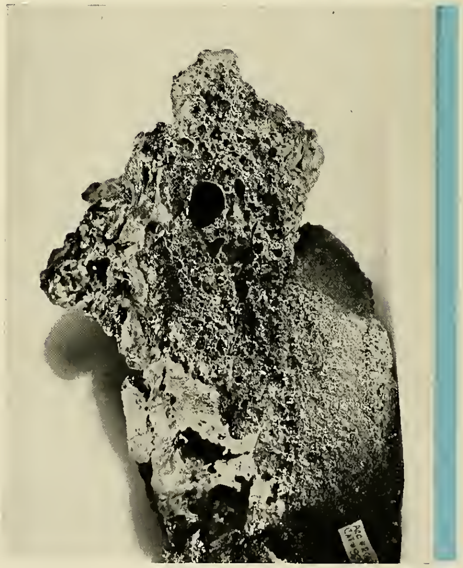
(Above) AN IMPOSING EXPANSE in the northeast corner of Oregon. The characteristically level skyline in general marks the top of the youngest lava flow. Rivers have cut fine cross-sections of the flows here

WHEN THE LAVA was forced through the feeders it was charged with gases: water vapor, carbon dioxide, and many others. As the molten rock spread over the land, the pressure on it became much less, and we have an example of what happens when we see the cap removed from a bottle of charged water. Locally, highly charged lava frothed violently, and the bubble walls solidified to form a sponge-like rock called "pumice." In less highly-charged and in more viscous flows the bubbles formed with greater difficulty and rose more slowly, but they were commonly of larger size, and those that were trapped in the solid rock formed vesicles, which give the name "vesicular lava" to that type of rock

STONE THAT FLOATS. The highly porous lava called pumice is lighter than water

WHEN LARGE GAS bubbles formed in the solidifying lava the type known as vesicular was provided

AMNH photos by Bierwert



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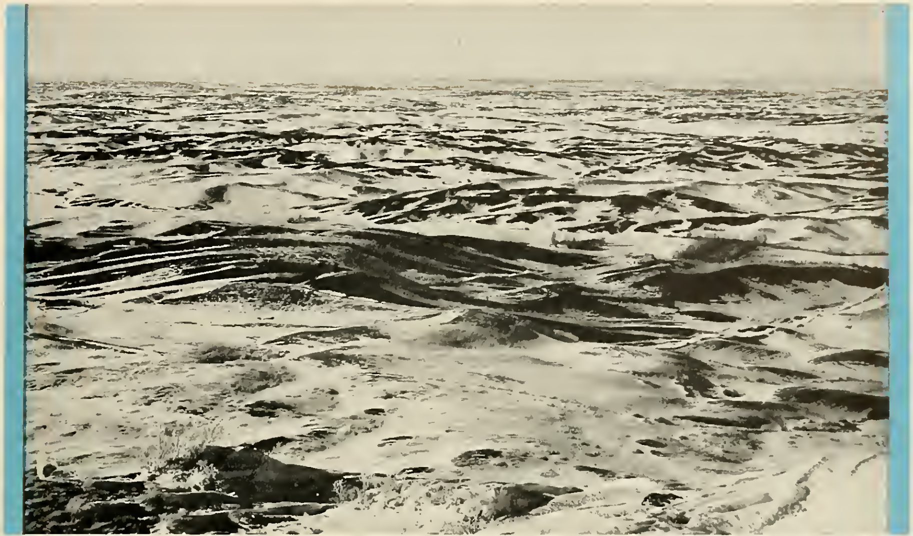

Photo by Courtesy of U. S. Department of Agriculture, Soil Conservation Service

But Let Us See what was happening to the appearance of the Inland Empire as flow after flow poured out upon it. We must realize that it was a broad realm of moderately mountainous country, on which rain fell, streams flowed, and vegetation grew in more or less abundance. The spreading liquid burned everything in its path, as flood after flood poured over the land, filling the valleys, rising to flood the lower hills, and eventually inundating even the uplands over wide areas. Here and there exceptionally high, isolated hills stood above the sea of lava, and to these the name "steptoes" has been given, after the famous Steptoe Butte in eastern Washington. A view from the top of this butte is seen above, a vast expanse on which erosion and the deposition of wind-blown material have produced a landscape that resembles the wave-capped surface of a great sea

Some Larger Mountain Groups also were too high to be covered by the fiery liquid. One of these, the Wallowa Range in eastern Oregon, rises in the background in the photograph below. Snake River, in excavating Hell's Canyon in the foreground, has cut through the lava flows and exposed splintery-looking masses of older rocks which were once hills but which were buried in the flood.

On three sides the flows sought their own level against outlying higher land, but just how they ended toward the west is not so well known. Possibly they simply spread until they were stopped by their own cooling

Photo by Courtesy of the U. S. Department of the Interior, Geological Survey

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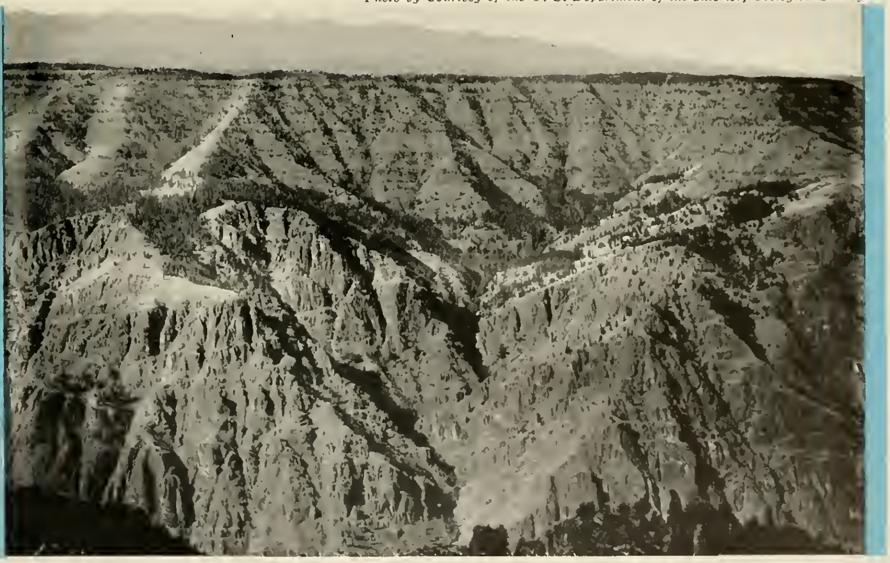

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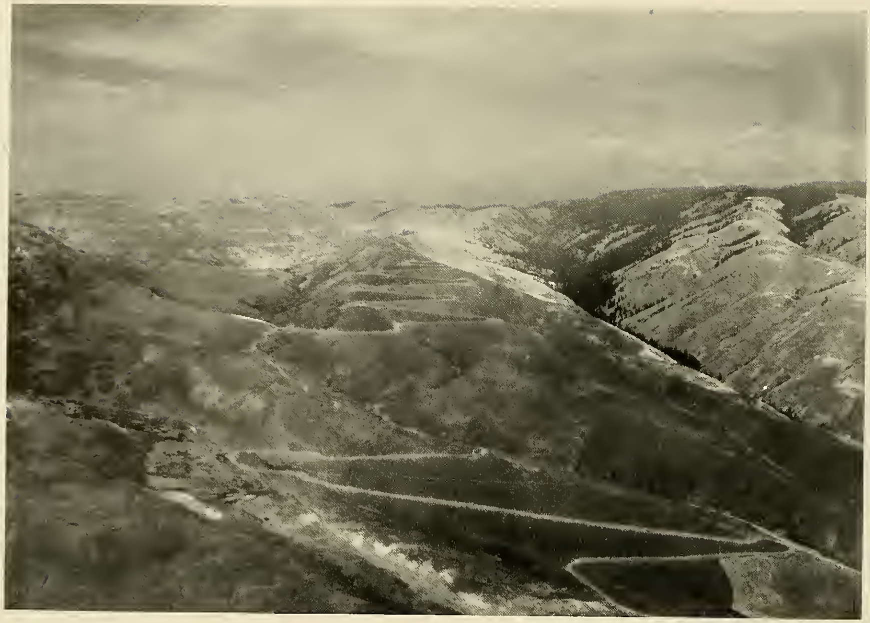

Photo by Courtesy of the Washington National Guard

A COMMON and widespread result of the floods was the interruption of established drainage courses. Streams were dammed, and large and small lakes were thus formed, particularly along the mountain fronts in Idaho. Into such lakes the streams carried sediment and leaves, logs, fruit, and other vegetable débris. Today the geologist finds these plant remains and learns from them something of the climate of the time. Strangely enough the trees were largely of the deciduous kind, not the conifers of the same region today. Maple, oak, birch, ginkgo, and sycamore are found, also a species of sequoia, a forerunner of the giant living redwoods.

Streams were dammed not once but many times, and enough time passed between the outpouring of many of the flows for the drainage to be re-established, soil to form, and forests to grow and mature.

Thousands of cubic miles of molten rock could not be removed from beneath the surface without causing the earth's crust to yield. So the Columbia plateaus settled, perhaps 2000 or even 3000 feet. In fact in some places the base of the lava is today below sea level. And while the center of the Inland Empire was sinking, the edges were being lifted up. Perhaps much of the lava came from under the mountains that now border the lava plateaus, and in that case the mountains may have been lightened enough to cause them to "seesaw" up to reach what is known to geologists as "isostatic balance."

At this time also the great Cascade Range was rising and carrying up with it the overlapping flows.

Locally over the plateau large blocks rose and settled independently, and where the lava could not bend it broke, producing great faults. The photograph above shows where the Whitebird Grade zigzags down the face of a great tear in the lava caused by movement of adjacent blocks, between Grangeville on the plateau of Camas Prairie and Whitebird. This great slope has evoked a gasp of wonder from many a tourist as he suddenly starts down it, and some of the best fossil leaves come from lake beds that crop out along this road

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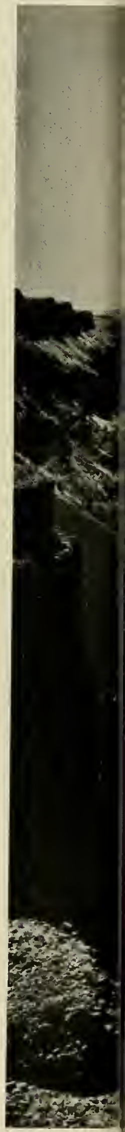


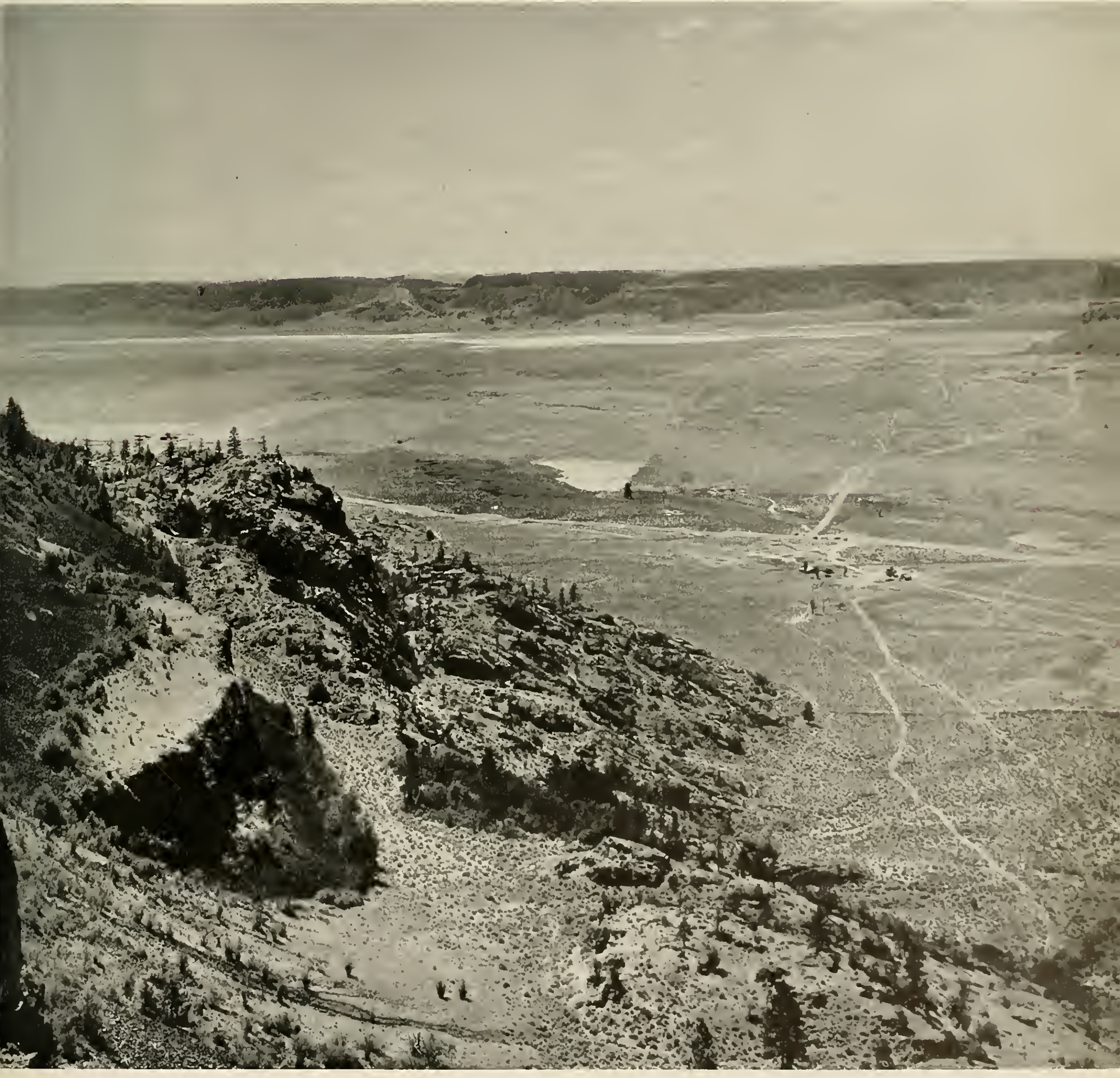
THE LAVA FLOODS had forced the Columbia River far north of its old channel, causing it to flow near the northern limits of the Inland Empire. And since there was no Cascade Range, the Columbia flowed right from the lava plain to the ocean. Then, as now, this mighty stream and its tributaries drained practically all of the Inland Empire.

As the crust began slowly to bend upward to form the majestic Cascades, the westward flow of the river was impeded. Had the uplift been faster than it was, the river might have been dammed completely and a huge lake would have been formed; but the cutting power of the stream was too great, and the river was able to gouge its channel faster than the crust was uplifted. Thus came into being the noble gorge of the Columbia through which the river still flows on its way to Portland and on to the Pacific Ocean

With the dawn of the Quaternary period about two million years ago, the whole earth began to feel the effect of changing climates. The polar icecaps expanded, and alpine glaciation began in mountain ranges much nearer the equator than formerly. Eventually a great glacier pushed down the Okanogan Valley and spread out in a broad sheet upon the northern part of the Inland Empire. And the mighty Columbia, throughout a part of its course in central Washington, was shoved relentlessly southward by the advancing ice, just as it had formerly been crowded northward by the lava floods.

When the ice had shouldered the river as far southward as it could, the stream, swelled in volume by the melting ice, "dug in" and cut for itself a new channel. But when the ice sheet had retreated and exposed once more the old channel of the Columbia, the river triumphantly re-occupied its former course and left the other one high and dry. Thus came into being the Grand Coulee, which is illustrated below. The frowning bluffs in this photograph once looked down upon the chilly, flooded Columbia River of glacial time. The size of the ancient river is brought forcefully home by the magnificent dimensions of this steep-walled valley. The end of Steamboat Rock, once an island in the glacial stream, shows on the right near the middle of the Coulee

Photo by Courtesy of the U. S. Department of Interior, Bureau of Reclamation



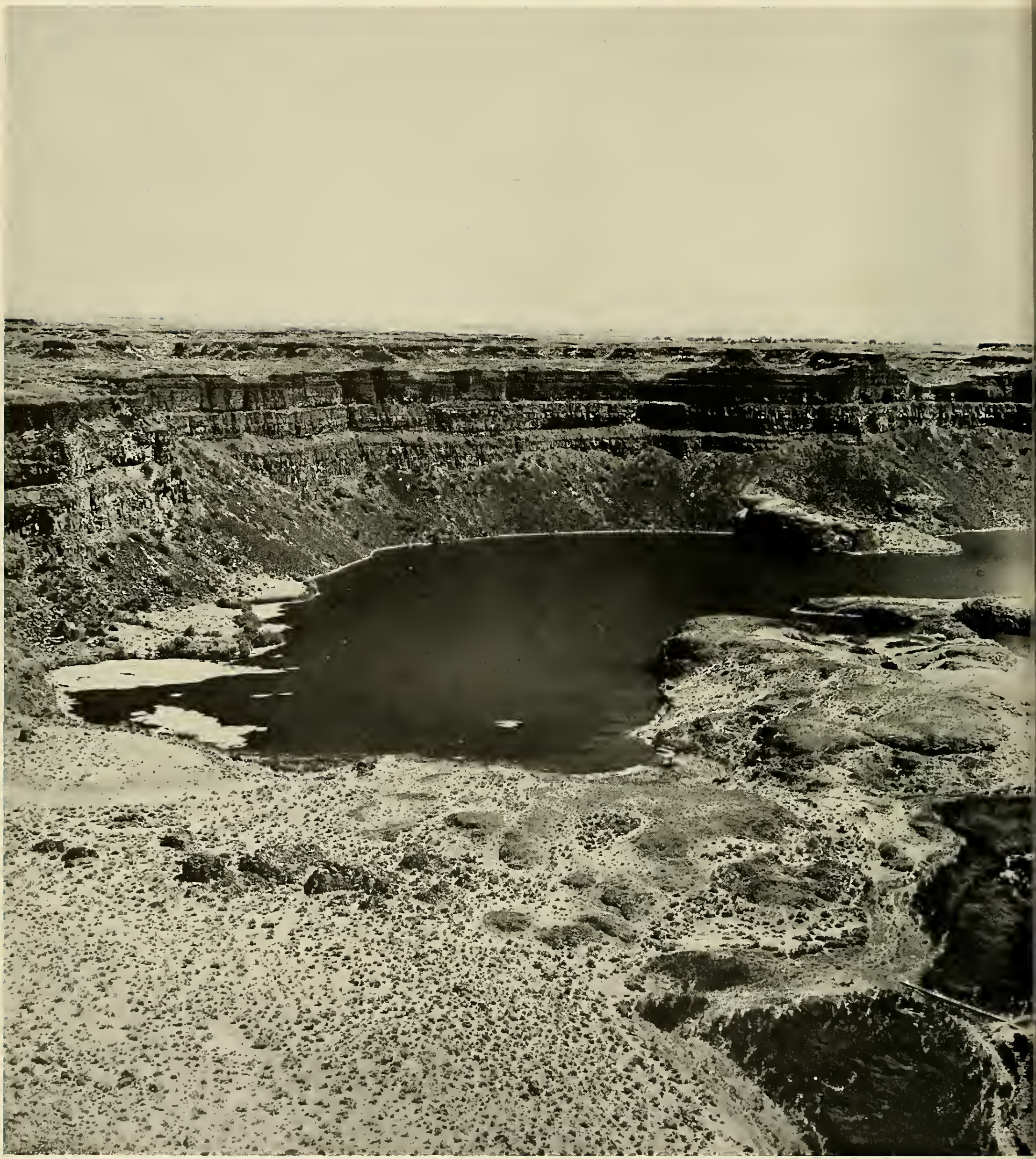


Photo by Courtesy of the U. S. Department of Interior, Bureau of Reclamation

10 A MANY-TIMES MAGNIFIED Niagara once plunged over the great cliff illustrated above, when the swollen Columbia poured down into Falls Lake, which remains today at the foot of this horse-shoe cliff in the Grand Coulee

11

As Shown above, the soil over much of the Inland Empire is many feet thick, and it is the boon of the wheat-growing Palouse country and other sections of the Inland Empire. How this deep soil was formed has long been a subject of debate. One group firmly argues that the soil was formed largely in place, by the weathering and disintegration of the topmost lava. The other holds that it was largely deposited from the air, in which it may have been carried great distances by strong winds. The latter group points to the fineness of the particles and the great quantities of dust that are carried about by strong winds today.

But other parts of the great Inland Empire have practically no soil at all and are called "scablands." There the surface is in many places virtually as bare as a billiard ball. Was there ever soil over these parts? Was it removed by wind or running water as rapidly as it formed? Especially east and southeast of the Grand Coulee the scablands are complexly scored by channels that must be old water courses. But the complete explanation is not yet known

12

The Soil of the Inland Empire is rich. The semi-aridity of the area prevents large parts of the plateaus of the Columbia from being intensely cultivated; nevertheless wheat grown in the Inland Empire amounts to nearly 50 million bushels a year *(see photograph below)*

Photos by Courtesy of the U. S. Department of Agriculture, Soil Conservation Service

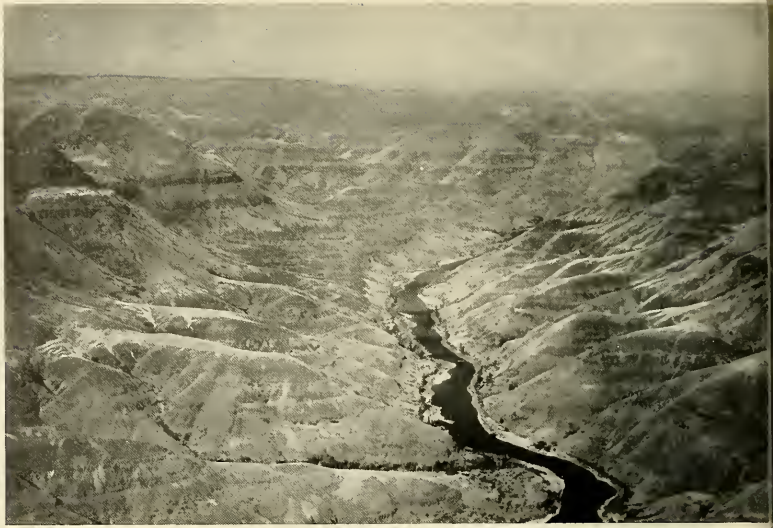


Photo by Courtesy of the Washington National Guard

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THIS brings us to the last and shortest chapter of our story, which belongs to man and to what he is attempting in this great empire. Human endeavor has already yielded rich returns. This far-flung mountain and desert-bordered land even now supports a sizable population of sturdy Americans in spite of the long, dry summers, during which the water problem is in the minds of all. Scarcity of water might seem surprising in a region crossed by such great rivers as the Clearwater, Salmon, Snake, and Columbia. But the reason is plain. Most of the streams are fed from the highlands bordering the plateaus and flow throughout most of their courses in deep, steep-walled canyons. Irrigation is therefore frequently impossible except in the lower parts of the valleys, as is apparent in the photograph at right. This shows the valley of the Salmon River near Grangeville, Idaho, where the river, in carving its valley, has left a well-developed, step-like terrace on each side. These terraces resulted when the river was able to cut a wider valley than it has succeeded in doing at its present level. Its task in doing this may have been simplified by the presence of one of the relatively soft lake beds that are abundant between the layers of lava in this vicinity

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BUT THE VISION of our modern empire-builders is broad. Streams once blocked by seething lava or glacial ice can also be dammed by man. Power can be developed on a vast scale, great storage reservoirs can be provided, and township after township irrigated. Already we have Bonneville Dam across the Columbia in its deep gorge through the Cascades. And farther upstream the much vaster Grand Coulee Dam project is well along toward completion, as shown in the photograph at right. Here is being built the largest man-made structure ever conceived. At this point the Columbia River has carved through a relatively thin cover of lava flows and filed its way deep down into an underlying granitic hill. The flows are the dark, horizontally-banded rocks near the hill top, whereas the granite is as light as the concrete of the nearly-completed dam.

The great valley will be flooded 150 miles to the Canadian border. Giant turbines will convert river energy into electric power, a fraction of which will be used to pump river water nearly 300 feet above the reservoir level into the Grand Coulee, where it will again be impounded in a reservoir nearly 20 miles long. From this higher reservoir the water will be distributed for irrigation over the broad, parched area southward toward Pasco on the Snake River.

Thus ends the story of the Inland Empire. We have traced its history from the dim geologic past to the present. Many events have been recorded in its rocks and landscape since the first fiery floods welled out over its primordial surface. Even stranger things may happen in the future as man learns to control more and more of nature's processes

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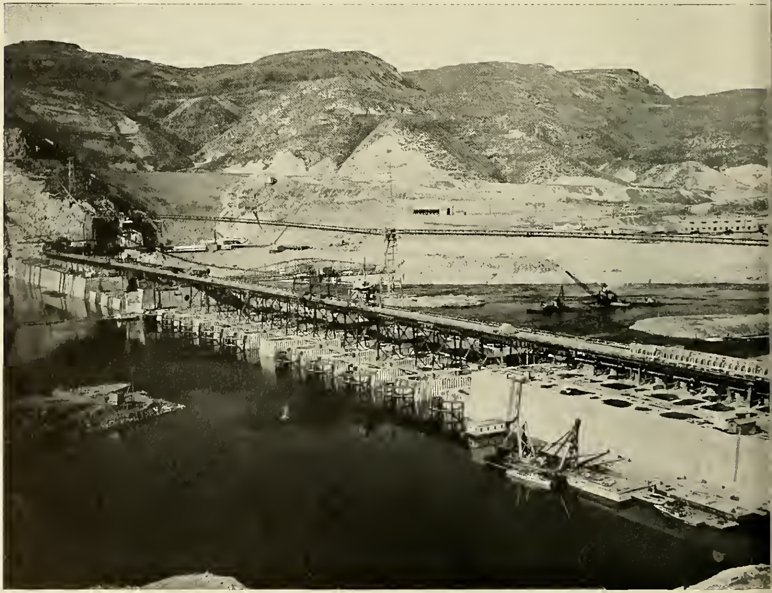
Photo by Courtesy of the U. S. Department of Interior, Bureau of Reclamation



GEM FOR APRIL

The diamond, unrivaled for its enduring hardness, is bright in beauty and soft in sentiment

By Frederick H. Pough
Assistant Curator, Geology and Mineralogy,
The American Museum of Natural History

Least traditional of all the birthstones is that selected for April, because the diamond was probably not known to the ancients. It first appears as a birthstone in the revised breastplate of the early eighteenth century Poles, substituted for sapphire. By then, of course, the singular qualities of the diamond were well understood and impressed upon the minds of all, even though the stone had been invested with mystery for many years. It was so hard it could not be worked, and the Hindus (who first had the stones in any quantity) cleaved out flat flakes which then were set in jewelry, often with colored foil beneath them. It was not until many years later that it occurred to anyone that diamond itself could be used to cut diamond, and we then see for the first time some of the beauty of this unique stone.

The name is derived from Greek *adamas,* which means "the unconquerable," and was given because of the diamond's resistance to any kind of abrasion. A myth asserted that diamond could not even be crushed upon an anvil, so hard was it—a severe experiment for any gems which were so tested. For this hardest of all stones has an excellent cleavage and can be crushed as readily as many other stones. Later the belief arose that stones became soft and workable only after being dipped in fresh goat's blood.

Diamonds are composed of pure carbon. Though carbon is a light element, diamonds are relatively heavy, because the carbon molecules are so closely packed in the crystal network that they weigh more, just as a box full of sand weighs more than the same box filled with agate marbles. This form of pure carbon is colorless, when truly pure, but, like so many gems, very minor traces of impurity tinge the gem with color. Diamonds, which are among the commoner gems (the engaged couples of the world could not all be supplied with any other of the more precious stones), have been classified according to color. A fine white, with perhaps a tinge of blue, is regarded as most desirable, with yellow shades subtracting from the cost. When the coloration is attractive and becomes intense—rose perhaps, canary yellow, green, blue, or rarest of all, ruby-red—, the rarity and value are enormously increased.

Once the only source of diamonds was India, and many strange tales arose about the hiding place of these remarkable gems which filtered through to Europe. A common story, recounted in another version in Sindbad, is of a wonderful but unapproachable valley, the floor of which was studded with loose crystals. Pieces of meat tossed into the valley tempted eagles, who unwittingly carried the adhering crystals to their nests, from which they were gathered by intrepid, or terrified, explorers. It would be interesting to trace the origin of this myth, which is related in many versions in many lands.

The 125-carat Jonker I

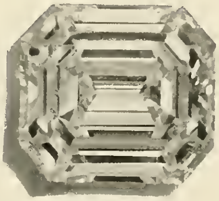


Photo by Courtesy of Harry Winston

The President Vargas diamond, a handful of the world's hardest material. Scheduled for cutting this month

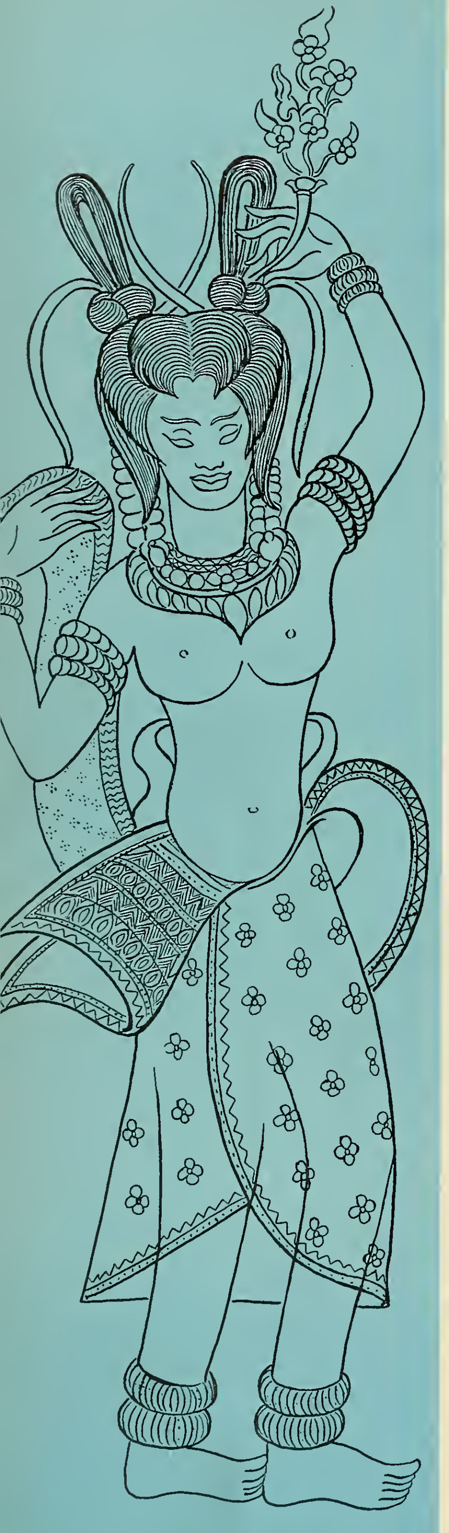
Photo by the author

When the Indian deposits were becoming exhausted, new finds were made in Brazil, and for many years Brazilian stones supplied the entire civilized world. Discovered in 1729, the Brazilian deposits, which are principally in stream gravels were operated at first by the Portuguese Government with slave labor, during which time a few important stones were found. The discovery of the South African deposits struck a blow to the Brazilian workings, but recent work has been more intense, and several large stones have been found in Brazil in the last few years. The largest, now known as the "President Vargas," weighs 726.6 carats and is slightly heavier than the recently found Jonker from South Africa.

The South African deposits were found to be of importance around 1870. They soon superseded all the other known deposits and have continued to be the principal producers down to this day. The United States has one diamond "pipe" (in Arkansas) which has produced stones of excellent quality, but it is little exploited at present.

Most of the myths connected with the diamond arise from its hardness. There was a belief that it would break the teeth if it were put into the mouth or rupture the intestine if swallowed. A flawed stone was believed to bring misfortune; and the shape of an uncut diamond was thought to be of significance. A triangular stone was said to cause quarrels, a four-sided stone to cause vague terrors, and a five-sided stone to bring death. Only a complete, six-pointed octahedron was lucky. Swallowing of diamond dust was supposed to be fatal, and the celebrated artist Cellini reports that he once escaped death only because of the fraudulent use of citrine quartz for diamond by someone who had been ordered to prepare such a fatal dose for him.

More modern legends attribute good fortune to the wearing of the diamond. To him who wears this stone come strength, fortitude, courage, and hence victory, and power to resist the devil and keep away nocturnal specters. However, as one author sagely suggests, diamonds were not too safe to own even though they rendered the owner fearless, for it was sometimes healthier and more conducive to longevity to have a little fear.



ANGKOR

THE LOST KINGDOM OF THE KHMERS

By TRUMAN BAILEY

Drawings and photo by Truman Bailey from Three Lions

Deep in the jungles of Indo-China, women fought beside men in the war that resulted in the ruin of one of the most spectacular and mysterious empires of the past. Today the drums of war sound once more near this historic site

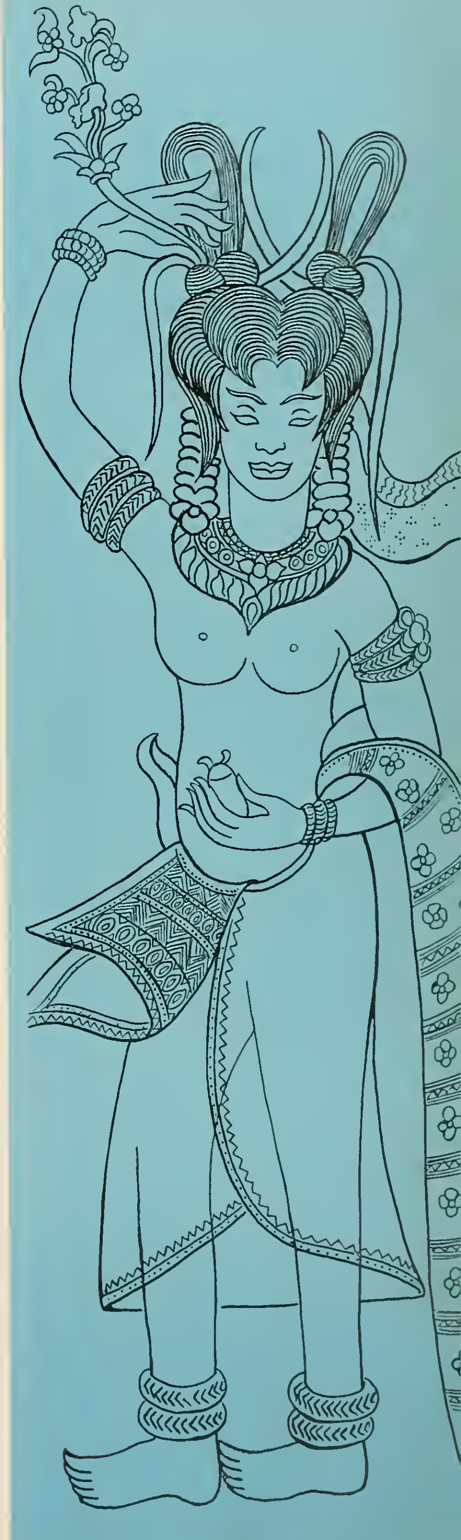
Accustomed as we are to hearing the story of civilization told against the background of Greece and Rome and Egypt, we are apt to lose sight of other glories of the ancient world. One of the most spectacular and mysterious empires of the past is the vanished kingdom of the Khmers. Located in dense jungle in southeastern Asia, its ruins tell their own version of the age-old cycle of conquest and decay, in a region on which the spotlight of international strife has recently once again been turned.

Three hundred miles northwest of the port of Saïgon in French Indo-China and approximately 100 miles from the frontier of Siam, or Thailand, stands the ancient capital of the Khmer Empire, a city enclosing an area of five and one-half square miles. This vast metropolis, Angkor Thom, has been described as being richer in architecture than fabulous Babylon at the time of Nebuchadnezzar, and more powerful than Carthage at the time of Hannibal. The towers of the temple, Angkor Wat, rose as high over the teeming city as those of the cathedral of Notre Dame. And conservative estimates have indicated that over a million persons once occupied the capital. All of which only heightens the haunting mystery of why the powerful and highly cultured people deserted their well-ordered metropolis. What happened to them?

For centuries before its real discovery, reports of the ancient kingdom were regarded by Europeans as too fantastic to be believed. As early as the seventh century, Cambodia is mentioned in the literature of China; and a precise, factual diary of the people and their habits during the year 1295, at the peak of their civilization, was recorded by a Chinese ambassador to the royal court at Angkor.

The fascinating story of Angkor first attracted wide public interest in the Western World when Henry Mouhot, a daring French naturalist, searching for rare plants and accompanied by only a handful of native guides, penetrated deep into the jungle of Indo-China and came upon the breath-taking ruins of the mysterious ancient city. His glowing description of what he had seen, published in the *Tour du Monde* in 1861, electrified the French Government into action, and no time was lost in gaining jurisdiction over the important site. Already settled in Indo-China, the French Government established a protectorate over Cambodia and started the momentous work of excavating Angkor from the jungle that had engulfed it for five centuries.

The important prize won immediate acclaim from the archaeologists who hastened to the scene. Just where the Khmer people came from remains in doubt, but there are many things to suggest that they had a spiritual and cultural bond with India. They were presumably ruthless conquerors, and were actively engaged in conquest and aggrandizement from at least the sixth century to the thirteenth. Early in the ninth century, under Yaçovarman II (a Javanese, probably from Sumatra), they founded Angkor, which means "The Capital," and the basis of their supremacy in Cambodia was established. Settled in this seemingly impregnable stronghold near Tonlé Sap ("The Great Lake"), they ruled through the ensuing centuries, and the trumpeting of their fearsome, armored battle elephants echoed over all this southeastern portion of



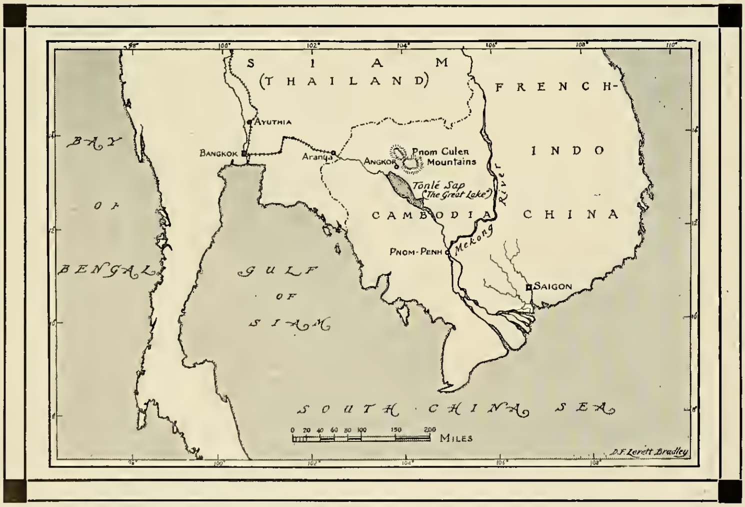
Asia. A well-equipped navy added to their conquests around the lake and along the Mekong River, while countless slaves toiled unceasingly to move the huge sandstone blocks from the Pnom Culen Mountains to the plain of Angkor, to build temples, roads, and bathing pools.

The progress continued well into the fourteenth century. From the wealthy land the toll was so large that, finally surfeited with feats of arms, the Khmers relaxed to enjoy the opulence of their conquests. Perversion and easy living softened the sturdy fiber of the race, and greedy princes started plotting among themselves. Meanwhile the star of the oppressed peoples of Thailand to the west was rising, and the Annamese to the east were gaining strength. Raiding parties swept out of the jungle in sudden forays. Surprised at their successes, these parties grew in size until huge well-equipped, well-trained armies were thundering at the city gates. The power of the Khmers, divided within, made its last stand with women fighting shoulder to shoulder by the men in an attempt to repel the invaders. But the end was inevitable, and finally the power of the once invincible nation was shattered.

Unrelenting, the attackers attempted to destroy every vestige of the hated civilization. But the Khmers had built well, and the solidly-placed standstone resisted their efforts. The invaders were forced to content themselves with bashing in the faces of the sacred statues, toppling over walls, and tossing hated idols down deep wells, from which they are to this day being recovered.

The Khmers, completely shattered, sought the protective wall of the jungle and settled first by the shores of the great lake. To the south and east of it on the banks of the Mekong they established a new capital at Pnom-Penh, in the fifteenth century. But owing to frequent invasions by the Siamese from the west and the Annamese from the east, the unhappy kingdom was reduced to a complete shambles.

Today two routes take the enterprising traveler to the ruins of Angkor. One, from the seaport of Saïgon, makes use of bus, river boat, or hired motorcar. The other, from Bangkok, follows the railroad through the otherwise impassable jungle to Aranya on the Siamese-Cambodian border, thence by motorcar to Angkor



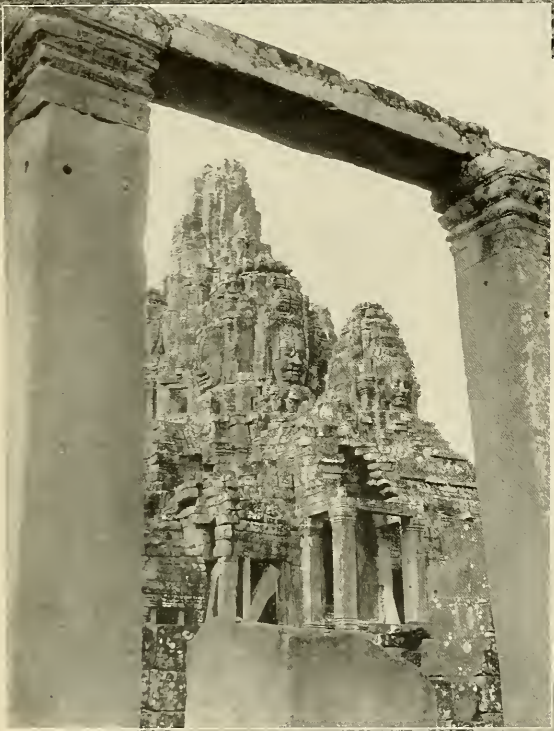
Once one of the world's great capitals. Possibly the last prince of the Khmer Empire looked out upon the ruins of his city much as the modern native is doing in the photograph at right

Photographs by Truman Bailey from Three Lions

(Right) The plant world triumphant over the works of man. We can imagine the sensations which must have stirred Henry Mouhot, the French naturalist who brought the ruins to public attention in 1861, when he came upon them buried beneath the vegetation of centuries. In the steaming jungle, vegetation grows almost as fast as it can be cut away; and though men are battling on many fronts to preserve the buildings, sufficient funds are not available to win a decisive victory

(Left) Today, as the visitor approaches and the forest opens up revealing the Bayon, the first impression is of a great pile of reddish-gray sandstone almost totally lacking in organization

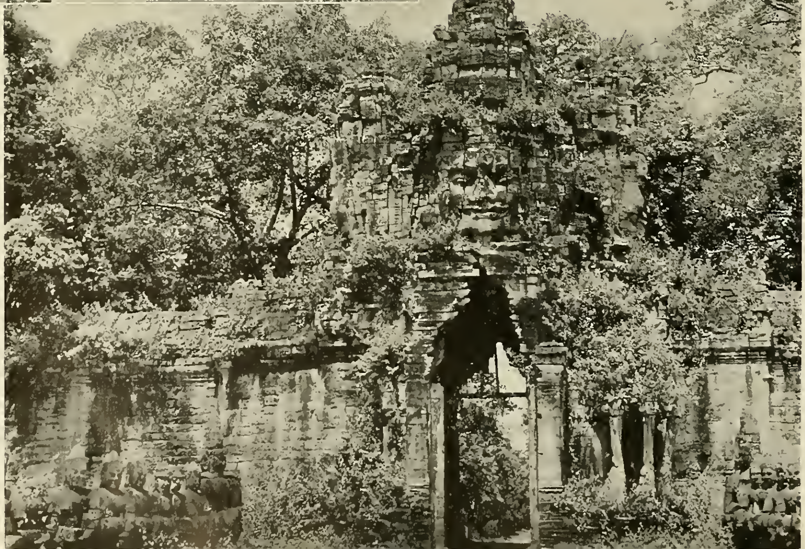
Photographs by Truman Bailey from Three Lions

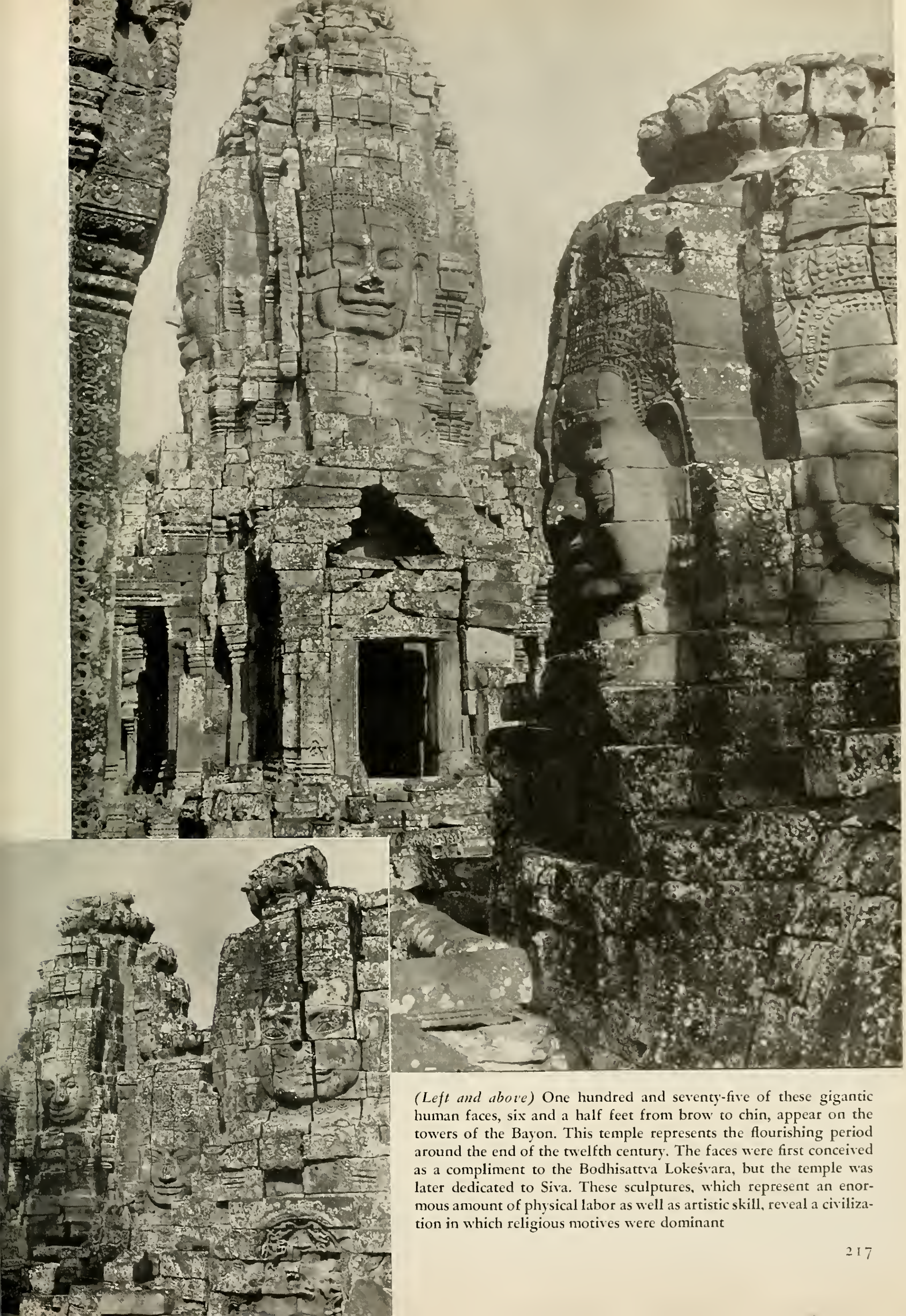


(Left) But as a closer view is obtained the great pile of sandstone resolves itself into a shimmering mass of gigantic faces. The deadly silence which hangs over this ghostlike scene, where once the sound of voices filled the air, makes it an uncanny experience to behold these giant relics of a vanished glory

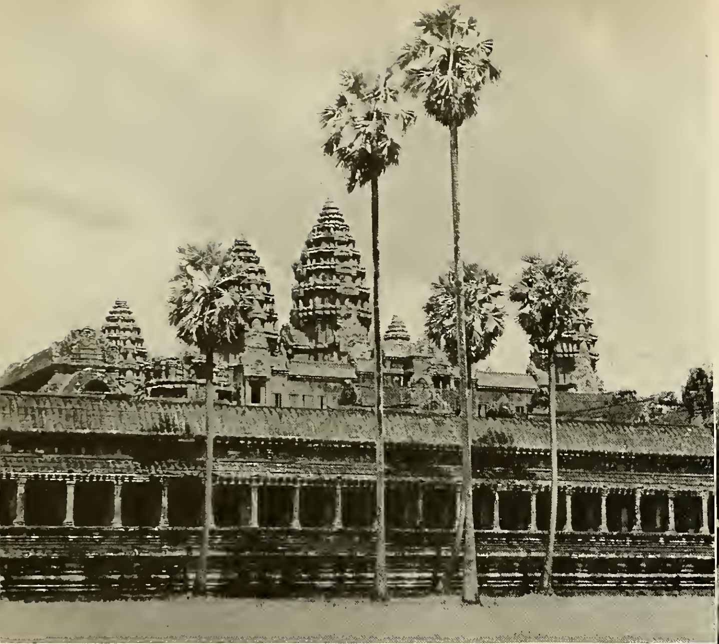
(Below, left) The Victory Gate is one of five gates which led to the town of Angkor Thom through the great protecting wall, which still stands. Each gate is 65 feet high and culminates in four human heads, said to be of the Hindu deity Siva, facing the four points of the compass. Through these gates filed the hosts of the Khmers, returning from their raids over the far-flung Indo-Chinese peninsula.

The royal city of Angkor Thom was founded in the ninth century. Surrounded by a moat 328 feet wide, and a wall 30 feet high, the enclosure of three and one-half square miles ultimately proved too small for the growing metropolis. The city spread until it sprawled over an area of at least 20 square miles. The living quarters of the people, which have seldom been mentioned, were doubtless built of wood and added greatly to the impressiveness of the city, though they have long since disappeared





(Left and above) One hundred and seventy-five of these gigantic human faces, six and a half feet from brow to chin, appear on the towers of the Bayon. This temple represents the flourishing period around the end of the twelfth century. The faces were first conceived as a compliment to the Bodhisattva Lokeśvara, but the temple was later dedicated to Siva. These sculptures, which represent an enormous amount of physical labor as well as artistic skill, reveal a civilization in which religious motives were dominant



Photographs by Truman Bailey from Three Lions

THE ARCHITECTURAL GENIUS of the race of people who built Angkor Thom found its fullest expression in Angkor Wat, the temple of the capital *(above)*. Rising 215 feet above the plain, it stands today the best preserved of all the Angkor monuments. A faultless organization of mass, it was designed to impress pilgrims who came to worship at this sanctuary of Vishnu, whose statue rests beneath the dome of the central tower

(Top, right) THE TEMPLE OF ANGKOR WAT, like all the other buildings at Angkor, was laid out on the points of the compass. But Angkor Wat faces west, instead of east, to accommodate the countless pilgrims approaching by a road which passed along its western side. A rectangular moat over three miles long enclosed the great building, across which runs a causeway paved with laterite resting on stone foundations four and one-half feet thick. This makes an avenue 225 yards long, bordered on each side by a parapet representing a serpent, a portion of which may be seen in the accompanying photograph.

King Suryavarman II, who built the temple to Vishnu, god of preservation, saw to it that his own likeness appeared frequently in its epic carvings. Khmer history is depicted on the sculptured panels, one of which is almost half a mile long

(Right) THIS GREAT AVENUE, elsewhere in Angkor, was demolished by the invaders, but an effort has been made to replace the existing parts. We are told by the Chinese ambassador Tcheou Ta-Kouan that 54 genii supported the giant Naga, or serpent, bordering the roadway. This would make a total of 108 statues to each avenue, which is still considered a sacred number in parts of far-off India and Tibet

Photographs by Truman Bailey from Three Lions

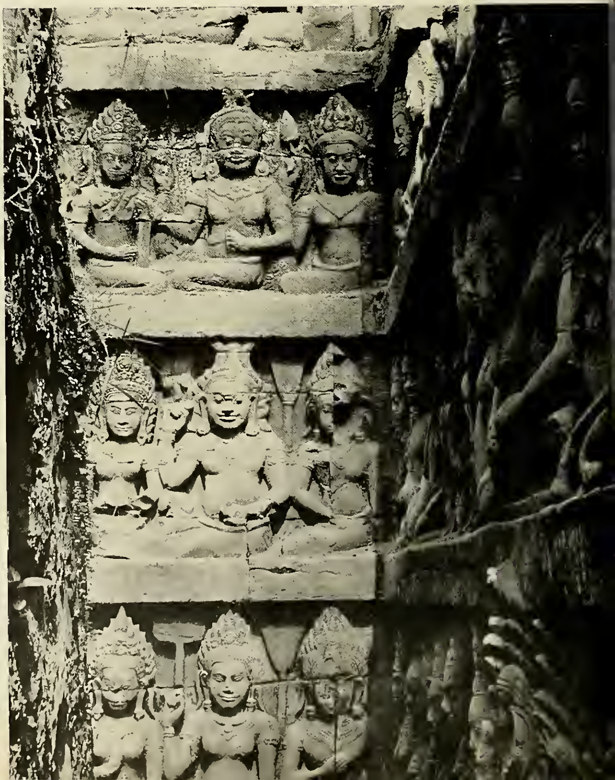
Experts conclude that the Khmers were skillful woodworkers who adapted their technique to stone. The huge blocks were quarried from the Pnom Culen Mountains, 25 miles northeast of the capital. From there they were rafted down the river to the great lake and dragged overland with wooden winches by slaves. The buildings are built upon a mound of solid stone laid very close together in interlocking fashion, without use of cement.

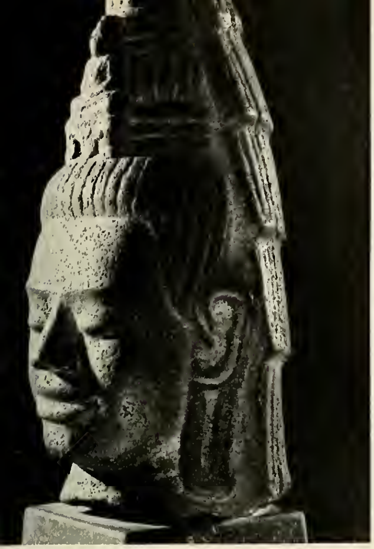
The architects created superb entranceways like that at left, and there is evidence that doors once swung in the frames, though the wooden parts have been stolen or have rotted away. Adept at smelting, they used much iron, and the tools and weapons found are almost identical with those in use among the modern inhabitants. Towers like the one shown here were doubtless gilded, as there is still evidence of a yellowish crust. Furthermore, the Chinese ambassador to Angkor at the end of the thirteenth century mentions its "towers of gold."

As each succeeding flight of stairs mounts heavenward at Angkor Wat the pitch becomes steeper and the flight longer

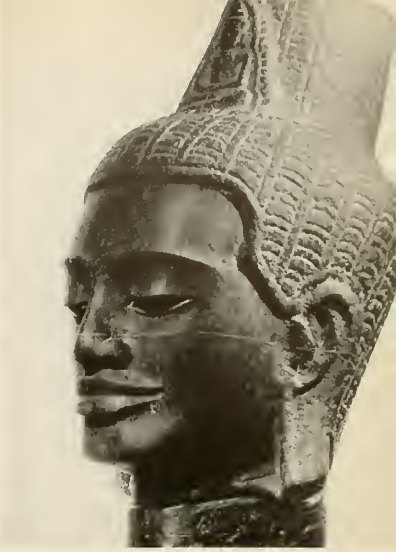
(Below) The joyous "Terrace of the Leper King," whose designation is of unknown origin, is a zigzagging passage, open to the sky above. Today countless monkeys chatter in the treetops and brilliantly plumaged birds flutter about, scolding when they are disturbed. As the visitor, moving silently on the matted greenery, explores this lost kingdom, an indescribable sense of excitement takes possession of him, as though he had been thrust into an imaginary world created by the pen of Rider Haggard

(Below) The deities which line the inner passage of the terrace represent all manner of attendants to the king, including jugglers and sword swallowers

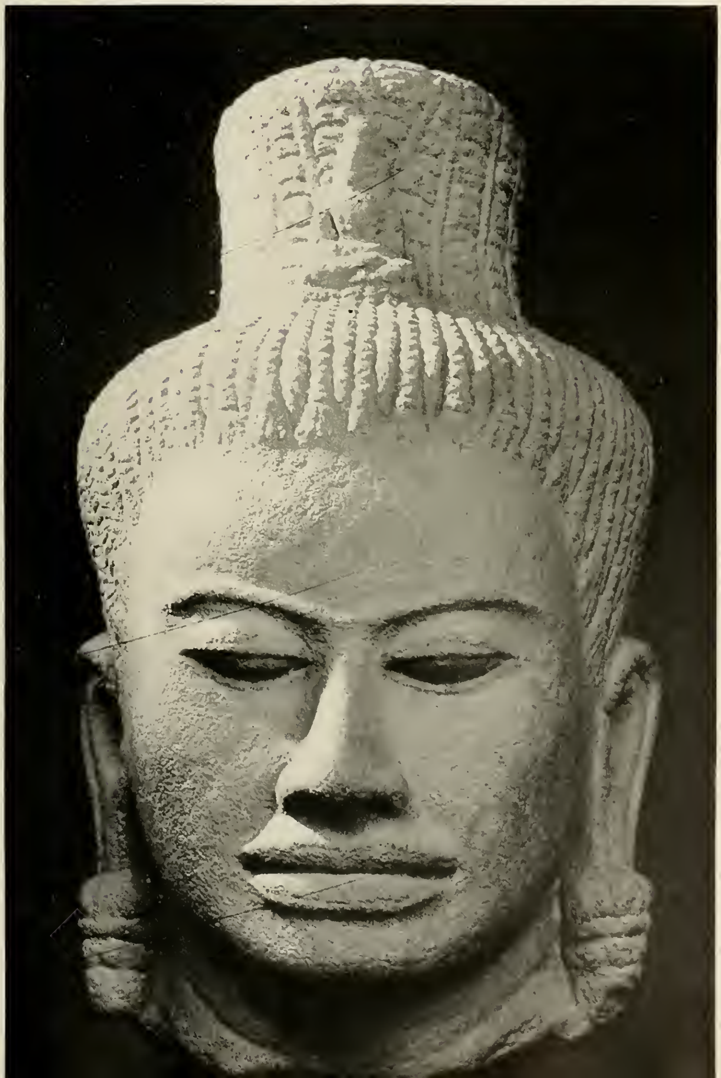




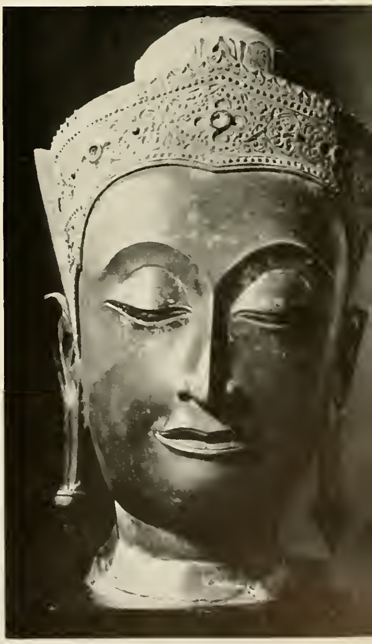
(Left) A NINTH CENTURY KHMER FIGURE from the Angkor region: the head of a devata

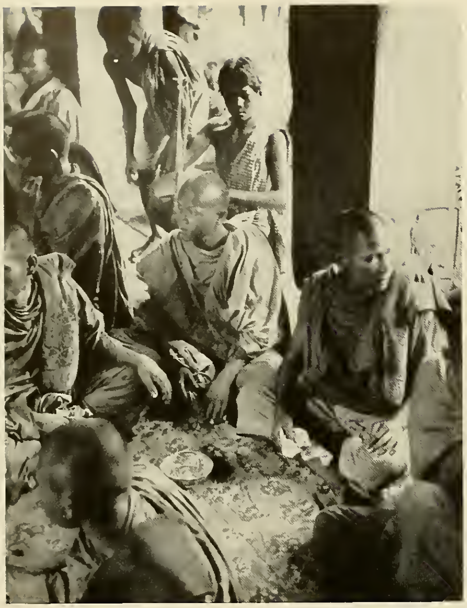


(Right and below) TWO EXAMPLES of twelfth century Khmer sculpture from Angkor: heads of bodhisattvas



(Below) A POST-KHMER BUDDHA of the fifteenth century, from Ayuthia in Thailand, 220 miles northwest of Angkor



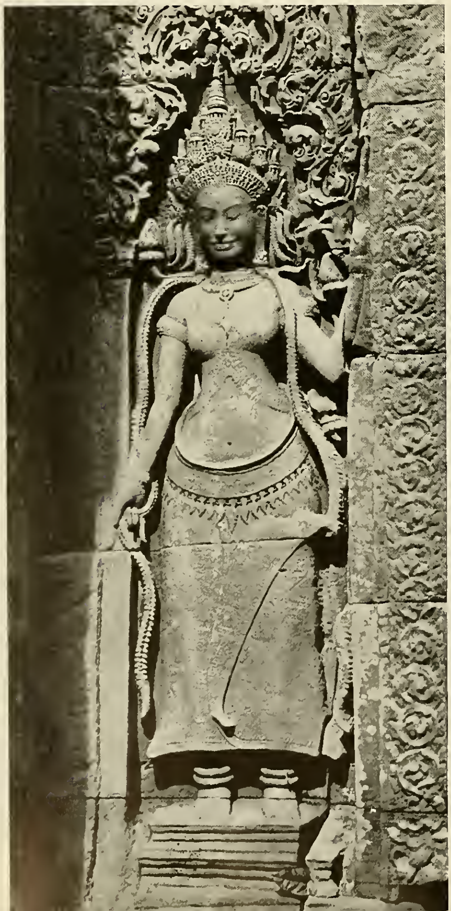


Photos by Truman Bailey from Three Lions

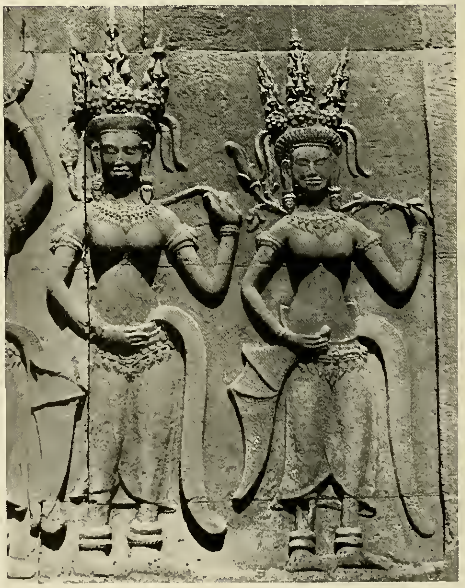
(Left) THE ONLY PEOPLE now actually living in the ruins of Angkor are mendicant Buddhist priests, who have a monastery within the precincts.

The purest form of Buddhism became corrupted as it spread through the Orient. In Cambodia today a doctrine known as the Hinayana, or "little vehicle," is currently popular. But in ancient Angkor, the Mahayana, or "great vehicle," was in vogue

(Left, below) AT EVERY TURN the visitor is greeted by lovely maidens, devatas and Apsarases, Buddhist divinities who smile, dance, and offer flowers

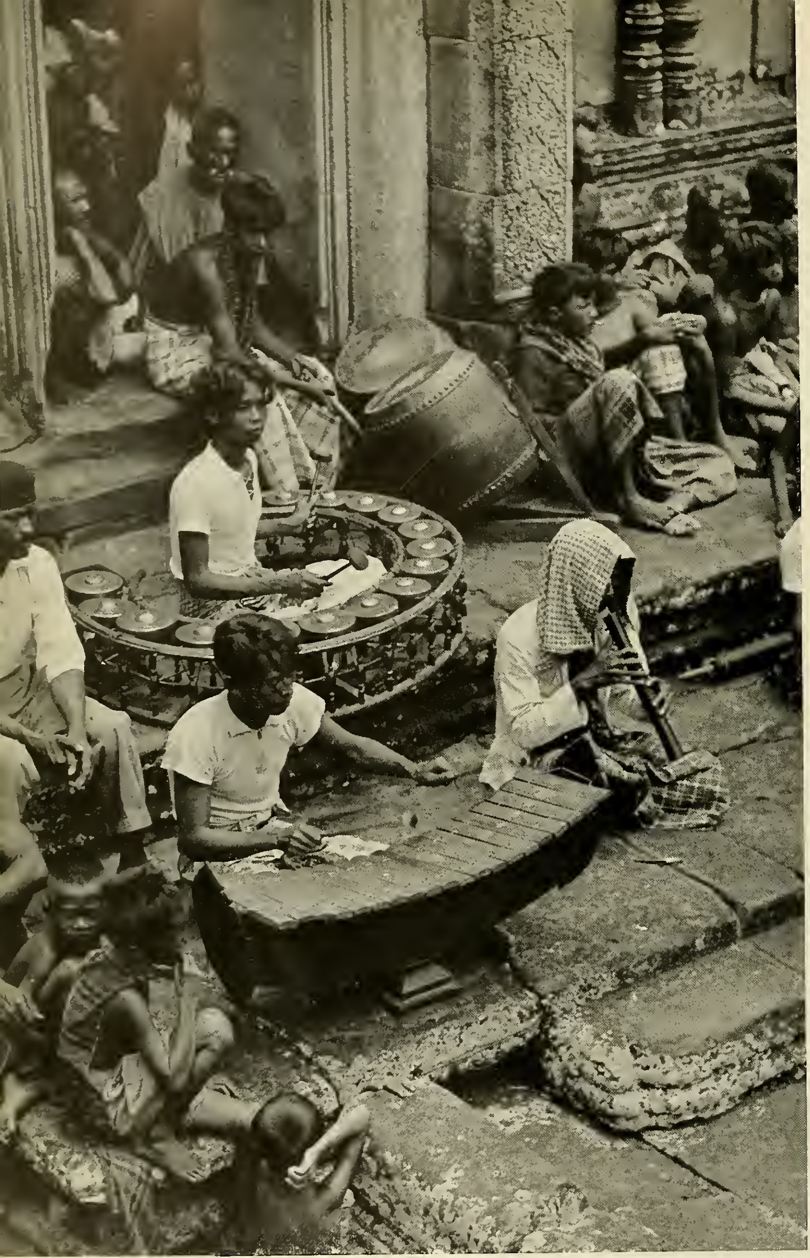


THESE many divinities are ladies in waiting to the gods and make Angkor Wat a corner of Vishnu's heaven



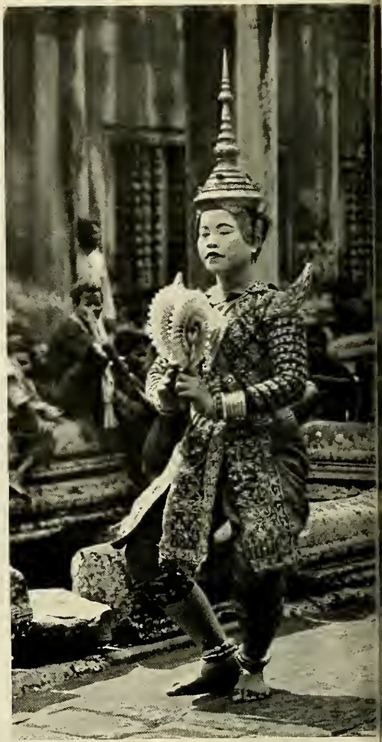
Yesterday and today on the site of the Khmer Empire

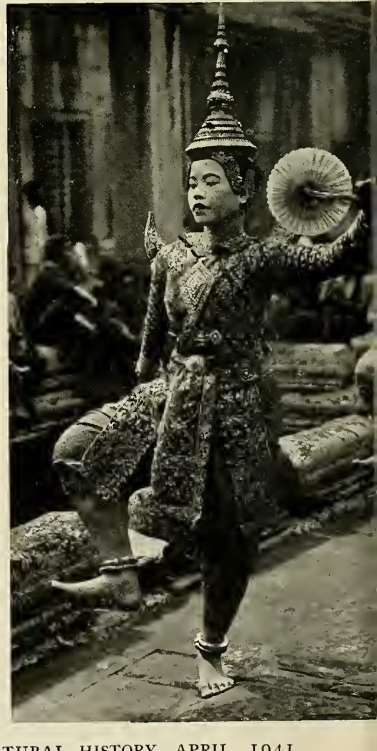
A dance troupe belonging to the retinue of His Majesty, the King of Cambodia, preserves the intricate steps of the symbolic dances of the country of the Khmers. The dances, most of which depict legends of religious origin, were taken by the moderns from the ancient Khmers, and through the years they have retained a remarkable purity. Here the modern scene merges with the ancient, as the Royal Troupe performs the movement against the background of Angkor's sculpture



Photos by Truman Bailey from Three Lions

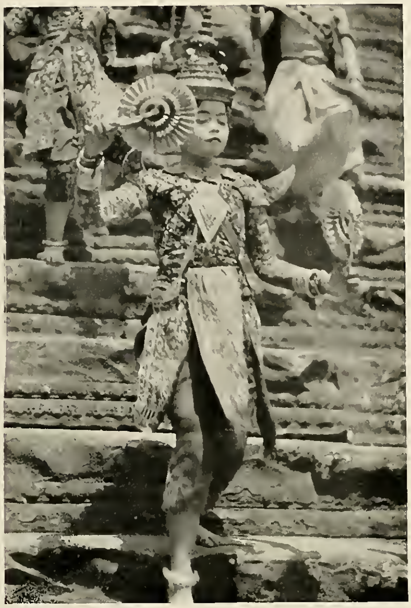
THE MUSICIANS *(above)* follow no written score. The theme has been handed down from generation to generation, and the players may improvise at will. Gongs, drums, and a reedy flute are favored instruments. Rice paste gives the drums a higher note, and they are played by tapping and rubbing

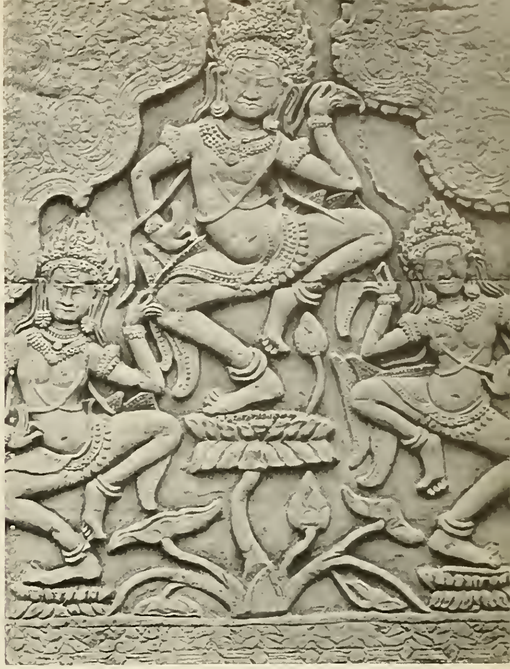




(Right) THE DANCERS balance their weight firmly on their bare feet, rarely on their toes, and the graceful postures of their hands and feet resemble closely those in many of the ancient sculptures. These action photographs were not posed but were part of the continuous ballet. Though the Cambodian ballet is sometimes slow of tempo, the postures frequently follow each other in such rapid succession that the effect is like the fluttering of a bird

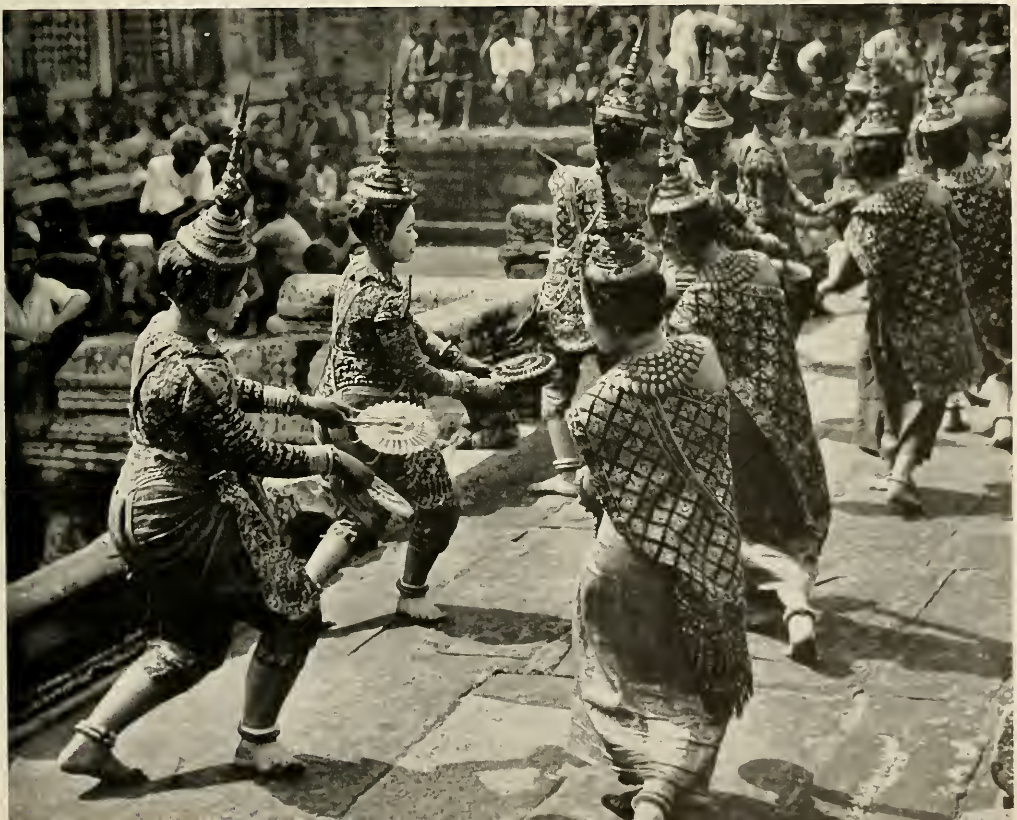
(Below) THE DANCE OF THE FANS is centuries old. Rarely, however, in modern times is the native ballet witnessed actually within the ancient temple, for the troupe generally performs publicly on the outside

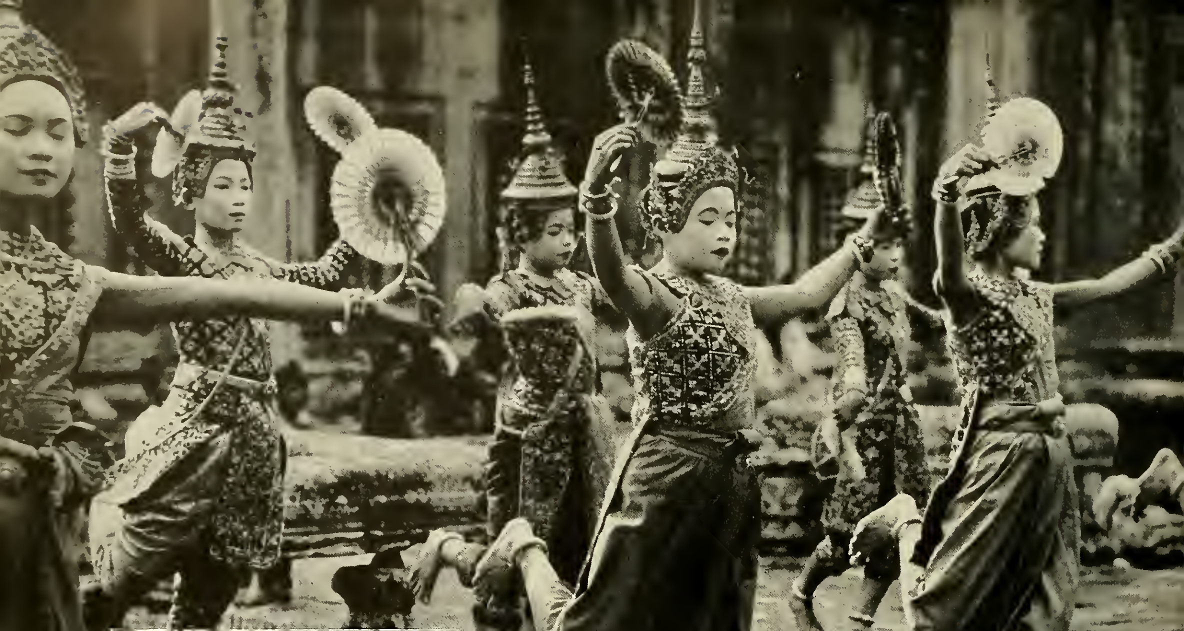


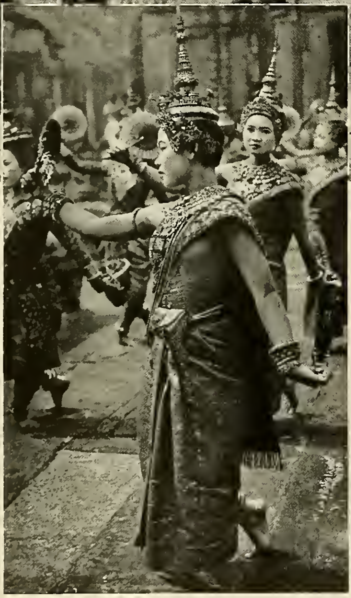


(Above) THE CARVINGS on the walls show dancers in poses similar to those followed today

THE PERFORMERS are exclusively girls, but men are indicated by knee-length breeches and other distinctions in costume



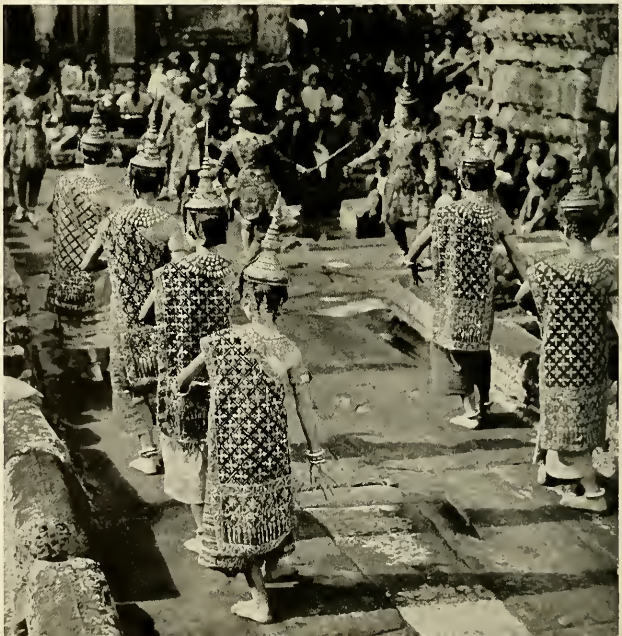




(Above) THE FACES of the dancers are heavily coated with thick white powder, their eyebrows penciled, and their lips painted a brilliant red. Centuries ago, Tcheou Ta-Kouan wrote in his famous diary, "Among women of the nobility you will find persons white as jade," an appearance probably resulting from this same practice

(Left) THE HANDS of the dancers are employed to create an infinite variety of lovely patterns

Photos by Truman Bailey from Three Lions



(Right) THE COSTUMES are painstakingly made and are highly valued. Dull reds, yellows, purples, and greens predominate in a low key, through which is interwoven a rich pattern of gold. The jewelry is gold, heavy and studded with uncut gems. The headpiece is papier-mâché, gold-leafed and set with gems or glass of proper color.

Thus against the background of their ancient monument, the people of Cambodia preserve some of the living art of the mysterious Kingdom of the Khmers

THIS ROBIN OF MINE—*From some place south he gypsies along, giving his cheery morning salute, and as if by magic each spring he finds his way to my back yard, making it a robin resort full of robin affairs*

By Roy L. Abbott
Professor of Biology, Iowa State Teachers College

I CALL HIM my robin because each year for the past five he has suddenly bounced into my tiny back yard about the middle of April, to remain with me till September. I know him to be my robin because of a shiny copper band around his leg with which I presented him when he blundered into a sparrow trap the first year of his arrival, and better yet by the fact that he is a freak in color. Half of his tail feathers are white.

I believe that he knows me, too. At any rate, from the very moment of his coming he shows no fear. The four or five other males who usually arrive with him keep at a respectful distance, but he darts about as certain of himself as if he owned the place. He comes within arm's reach of me to take a proffered worm, gazing at me steadily all the while with his great dark eyes, each of which is so large that it occupies as much head space as his brain. If I had eyes of proportionate size, each of them would weigh two and a half pounds.

Where did he come from? Well, he hasn't told me, of course, but I can safely wager that it was somewhere south of me; and if he is as fond of his winter home as he is of his summer resort, he probably goes back to the same little spot each fall. But whether he spent his first winter in southern United States, Mexico, or only 200 or 300 miles away, he was doubtless born here in Iowa. On that long first journey north, why did he happen to choose my back yard as a nesting place, and how does he manage to find it each year without map or compass? Nobody knows the full answer to those questions, and as I stare at his sleek, well-groomed form, I can only guess. Certainly as I see him this morning, although he arrived only yesterday, he shows no fatigue and no travel stains, nor loss of much of his fat reserve on his probable 1000-mile trip.

But uncommunicative as he is concerning his journeying, men have found out certain things about his doings and those of his fellows, and even I catch onto some of his ways now and then. For one thing, from what I have seen of him and what I have read, he doesn't make all this north-south trip as a nonstop flight as do some of his cousins, the golden plovers, for example, who fly over the sea. With him it's rather a sort of picnic-journey—or maybe I should say, a stag party on the northbound trek, at least, for the males commonly migrate together in the spring. Hence my robin looks clean and well fed this morning, for he started north probably a month ago and has been taking his time about getting here, flying two or three hours at a stretch, perhaps, and then stopping off for food and rest whenever he felt like it. Moreover, in that two or three hours of flight he may not have covered more than 50 or 75 miles, for contrary to popular opinion, my robin doesn't average more than 25 miles an hour while migrating.

Just a few days ago, a small flock of robins—I judged them to be migrating—happened to parallel my path along a country road. They stayed with me for half a mile or more, and during that period the speedometer of my automobile showed almost exactly 25 miles per hour. At various times, also, I have studied mourning doves in the same fashion, and although commonly supposed to be speedsters among the birds, I have never clocked one at more than 50 miles per hour. Audubon believed that mallards average about 80 miles per hour in steady flight and that on occasion they can make 120. But in my judgment, the distinguished naturalist far overestimated their real speed, for a group of high-flying mallards that I pursued in an airplane last year on a windless day could make only 65 miles per hour, and they were obviously terrified and putting out all their power.

Part of the confusion in the popular mind concerning the speed of birds is doubtless due to failure to understand the difference between "air speed" and "ground speed," this last term meaning speed with reference to objects on the ground. Winds, whether the bird is flying with them or against them, make no difference in the air speed of a bird but they make all manner of difference in its ground speed. Suppose, for example, that on a calm day a bird flying at its best pace can make just 40 miles per hour. In this case its air speed and ground speed are the same, 40 miles per hour. If now we imagine this same bird flying its fastest down a 20-mile wind, its air speed is still the same but its ground speed has stepped up to 60 miles per hour. Such a bird, flying against a 20-mile wind will still have the same air speed but will be making only 20 miles per hour ground speed. Thus, the actual or air speed is what he should mean when we speak of how fast a bird can fly.

How did he find his way?

But regardless of his speed or how long he took to get here, the fact remains that my robin is here. And, as I asked a while back, how did he happen to land in my back yard, and how has he managed to find this same little spot year after year?

Perhaps the answer to the first question is simple: my robin just happened to land in my yard, and taking a fancy to his surroundings decided to remain there. But if I knew the full answer to the rest of the query: how did he find his way back to it again the next year, I'd know more than all the students of bird ways have been able to find out. My robin, of course, is not alone in his ability to find his way back to his little summer home; countless species of birds do this every year, and experiments have shown many birds to have an uncanny ability to return to their homes or nesting places even when forcibly carried far into strange country. Thirty years ago, Watson proved the ability of sooty terns to get back to their nests even when transported 1000 miles by water from their normal range. These birds were carried below the deck of a ship and hence could not see where they were going, yet they were back on their nests in five days after their release. Lincoln records that cowbirds banded in Illinois and then released at various widely separated points showed remarkable ability to return to the banding station; also that pintail ducks captured and banded in Louisiana and then released along both the Atlantic and Pacific coasts, were subsequently recovered at the same station or along the Mississippi; also that five out of seven swallows got safely back to Bremen, Germany, after being released near London over 400 miles away. The greater shearwater is a familiar bird to North Atlantic fishermen, but so far as we know, it breeds only on one small island in the South Atlantic, about midway between Africa and South America. Imagine a navigator traveling from the North to the South Atlantic in search of this tiny island without the fullest equipment, yet the shearwaters, equipped with nothing but their natural senses, show no difficulty in finding it.

What then are these "natural senses" that birds use in finding their way back when carried forcibly from their homes or in performing their normal migrations? Many students of bird migration still believe that birds depend largely upon the sense of sight, and that their lines of flight—the so-called "flyways"—are closely associated with the topographical features of the country. In other words, they believe that birds steer their paths by objects on the ground, such as watercourses—things fixed in their memories from a former trip. According to these students, the young birds of the season are led over the route by the older birds, and this first guided trip is supposed to be sufficient to fix in the visual senses of the bird a memory of the migratory path. Interesting as this idea is, however, it breaks down when generally applied, for some birds, such as western sandpipers, do not travel in flocks of old and young together. The young birds do not migrate until about a month later than the parents. These young birds then must have an instinctive sense of direction of the place to be reached, for they have never been over the ground before.

By bird's-eye view?

Birds undoubtedly have wonderful powers of sight, and after once traveling a given route, probably retain many visual memories of its topographical features. But what about those that migrate at night and in dense fog? Murres and other birds are known with certainty to fly unerringly through miles of dense fog, in which an aviator without instruments could not possibly keep an even keel, let alone a straight course. Obviously birds cannot depend upon topographical features to guide them under these circumstances, but it is only fair to say that anyone who has ever traveled at night in an airplane knows that nights are rarely so dark as to obscure all objects upon the ground, particularly rivers and shore lines. Hence birds might easily depend in part upon visual memory while migrating at night. In the case of flying over long stretches of water, however, the situation is entirely different. Because of the earth's curvature, even with eyes that were unlimited in range of vision, a bird flying across the Gulf of Mexico, say at a height of five miles, could then see only about a third of the distance to be traveled.

Therefore it does not seem that my robin's sight alone—for he, too, does some night journeying—or even all five of his senses working in co-operation, would be sufficient to explain how he finds his way to my back yard. In addition to his ordinary senses, there must be something else in that little black head of his—something which for want of a better term I am going to call a "sense of direction." Eyes and ears and his other senses doubtless aid him greatly, but these alone are hardly sufficient to guide him.

But regardless of how he manages to find me each spring, his chief business after getting here seems to consist entirely of three things: to get something to eat, to keep out of harm's way, and to raise a family. He seems particularly bent upon the food-getting business for the first few days after arrival and bounces about my back yard busily filling his belly with earthworms, seemingly unmindful of the several males who came with him. There are still plenty of worms for all, and no female has yet made her appearance.

My robin is an expert at catching these big, slippery worms. I never tire watching him at his hunting. Away he goes, racing like mad for a yard or so on those slender, wire-like legs, finishing his run with a few mighty hops and, at the conclusion of the last one, tipping his head close to the ground as if listening or peering intently. Then a few vigorous pecks, and he has grabbed something. Yes, it's a worm, and my robin sits back on his haunches pulling steadily. There must be nothing hasty about this extraction business, as experience has taught him, else the earthworm, clinging with all its powers by means of bristles which catch on the sides of the tunnel, will break in two. But the worm will tire from a steady pull and give in presently, and my robin seems to know this. There! the worm lets go suddenly, and the puller almost falls over backwards. Then two gulps, the worm is in his crop, and away he bounces in search of another.

Robin schedule

Well, Mrs. Robin, or at least the female destined to become Mrs. Robin, arrived last week, and things have been different in my back yard. For one thing, there are no males other than my robin there now. He saw to that at once. Of course there were some fierce brawls at first, but the other males seemed to feel that my robin had preëmption on the place and soon gave up the struggle. Other later migrating robins drop in occasionally for a bit of food, but my robin sees to it that they don't tarry long. Possibly that is one reason why robins have such a wide nesting range north and south: the earlier birds take up all the nearby places and the later ones are compelled to travel until they find unoccupied territory.

But now that Mrs. Robin is here and all rivals have been driven off, things soon settle down to a regular schedule of robin affairs in my back yard. May 1: my robin decides that the crotch of a big elm is the proper place for a nest, but Mrs. Robin decides differently. She chooses a two-by-four that forms a ledge just inside my garage window, and everyone is satisfied, including myself, for I can watch easily what's going on. May 2: the nest is well under construction. Although it is completed within the next two days it remains empty for yet another day, probably because of its muddy dampness. My robin takes no part in its building, but is seemingly an interested onlooker. Four eggs then appear, one on each successive day. On May 9, with the coming of the last egg, Mrs. Robin settles down to a twelve-day vigil, leaving the nest only long enough to eat. During her absence my robin does not sit on the nest, nor does he feed his mate while she is on the nest—as is the gentlemanly custom of a male rose-breasted grossbeak who is nesting nearby.

Family responsibilities

But my robin is greatly concerned for all that, and when the four tiny young appear on May 21 or thereabouts, he at once takes an active part in feeding them. From a darkened corner inside my garage I spend hours watching this feeding game and I am amazed by what I see. With a good pair of field glasses at such close range I can watch everything that goes on, almost as if I held the nest and birds in my hand. My robin and his mate take turns alighting upon the edge of the nest, each time with some kind of provender in their beaks, and each time they arrive four wide mouths are automatically thrown open to receive the offerings—wireworms, June beetles, crickets, grasshoppers, white grubs, hairy caterpillars and smooth ones, earthworms and centipedes, these, and even other creatures such as snails, all in endless succession from early morning until nearly dark. All four mouths fly open at once, and my robin places his beak with the food far down one of these gaping throats. But he sometimes withdraws his beak, food and all, and offers it to another Hence, I believe Herrick is right when he says that the parent bird always finds out which one of the young is hungry by first placing the food deeply against the inside of its throat. If the youngster is hungry it will make a swallowing action, and if it isn't, it won't. And if it doesn't make the swallowing reflex, the old bird then offers the morsel to a second youngster, sometimes even to a third before getting the proper response.

But such gourmands are they that it is small wonder that a young one (which I weighed) nearly doubled its weight in one day. And in ten days the four were crowding the nest almost to overflowing. Feathers sprouted from their skins like weeds from rich soil. In fact, so rapidly did they transform insects and worms into robin-flesh, they were out of the nest in less than two weeks, feeble flyers at first, but able to run around hard at the heels of my robin, who now takes practically all the burden of caring for them. For almost before the first brood are able to run about, Mrs. Robin has started a second nest.

Why does he leave me?

So the spring and half the summer for my robin and his mate are largely a continuous round of family cares. They are often terribly agitated by the appearance of a casual cat or dog, and in spite of my frequent presence, never allow me to approach without vociferous protest. Hence, by August both look somewhat worn and a bit tired. It is not long before they and their two broods begin to leave my yard—adding their numbers presumably to a great flock of robins which is nightly roosting in a nearby clump of box elders and young cottonwoods. Mr. Robin visits my yard occasionally until about the middle of September, sometimes accompanied by a few of his speckle-breasted young; but somehow he appears restless, and I can guess that the age-old urge of migration has come upon him again. In a few weeks he will be leaving me. Why? Is it because it will soon be too cold for him here? No, for experiments with many of our insect-eating, summer-resident birds have shown that all of them may be kept confined in outdoor aviaries at sub-zero temperatures if supplied with plenty of food. Also, each year, a good many robins seemingly lose their desire to migrate and remain north—even in the latitude of Duluth—all winter. Besides, my robin leaves the yard long before it is really cold, while the insects are still plentiful and before the earthworms have gone deep into their burrows. Apparently, then, migration is not just a matter of either temperature or scarcity of food or of both combined, although both perhaps played a part in far-distant times and doubtless play a part even today.

Perhaps, say one group of theorists, all birds of the Northern Hemisphere were nonmigratory in a distant geological time when conditions of food and temperature were such as to allow them to remain there the year around. But there came a shift in the climate, ice fields formed in the north and, advancing southward, drove the birds before them, thus causing a great concentration of birds in the temperate and tropical latitudes. Then came another shift in temperature, and the icecaps began to retreat, especially in summer, and the inhabitants of the congested regions eagerly repopulated the ice-free parts, retreating, of course, southward, each winter. Therefore, in migrating, our birds are only repeating today the great racial movements that took place in the past, movements associated with the north-south shifts of the ice sheet.

No, says another group of theorists, the ancient home of all birds was in the tropics. Here, due to pressure of population, especially during the breeding season, many birds pushed out from the crowded regions to places where competition for food and nesting sites was less keen. All of these adventurers, of course, retreated southward each autumn before the advancing winter. As the northern ice sheets receded, birds ventured still farther north in the spring but always remembered to retreat to their winter homes at the onset of cold weather.

So, according to these theorizers, a bird of today in migrating may be obeying only an ancient pattern laid down in its nervous system as the result of stimuli now long gone, a pattern perhaps even partly useless today but still functioning—a behavior reaction somewhat comparable to my wearing buttons on my coat sleeves, things for which I can see no use or meaning.

Still others, cashiering most of the above theories, see in bird migration largely a physiological reaction, originating in the sex organs, structures which they say develop periodically as the result of the increased light of the advancing spring. In fact, experiments with birds subjected to artificial light conditions like those of spring, indicated that a condition of the sex organs commonly associated with the spring season developed even in January. But crows so treated and then released were found in equal numbers north and south of the point of release, thus casting considerable doubt upon the validity of the theory. Also, it may well be asked why, if increased length of daylight is the stimulus to migration, do birds that winter in the tropics ever start northward? For there, days and nights are of almost equal length.

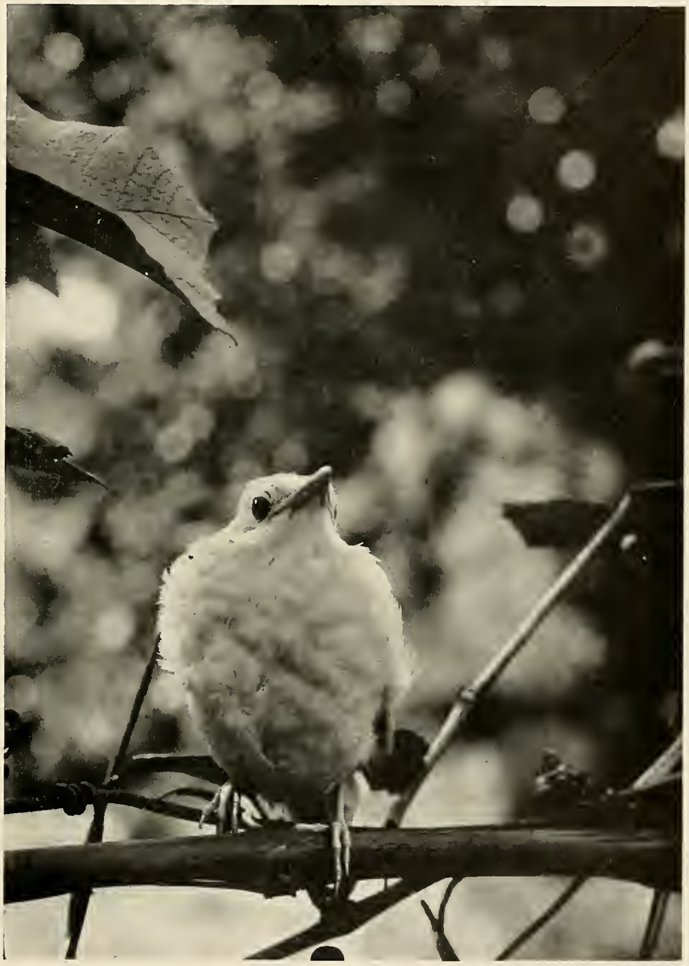
However that may be, I know that by late October my robin will have left me, and will be gypsying along, taking his time, traveling perhaps even more leisurely than when he went north.

My robin is a gypsy

Without him each summer my yard would seem empty. Like thousands of other bird-loving humans, I await anxiously those days each spring when once again a wave of cheery song will ride ahead of the rising sun, starting upon the Atlantic coast and rolling across to me here, even to the Pacific—the morning salute of my robin and his kind.

AN ALBINO ROBIN

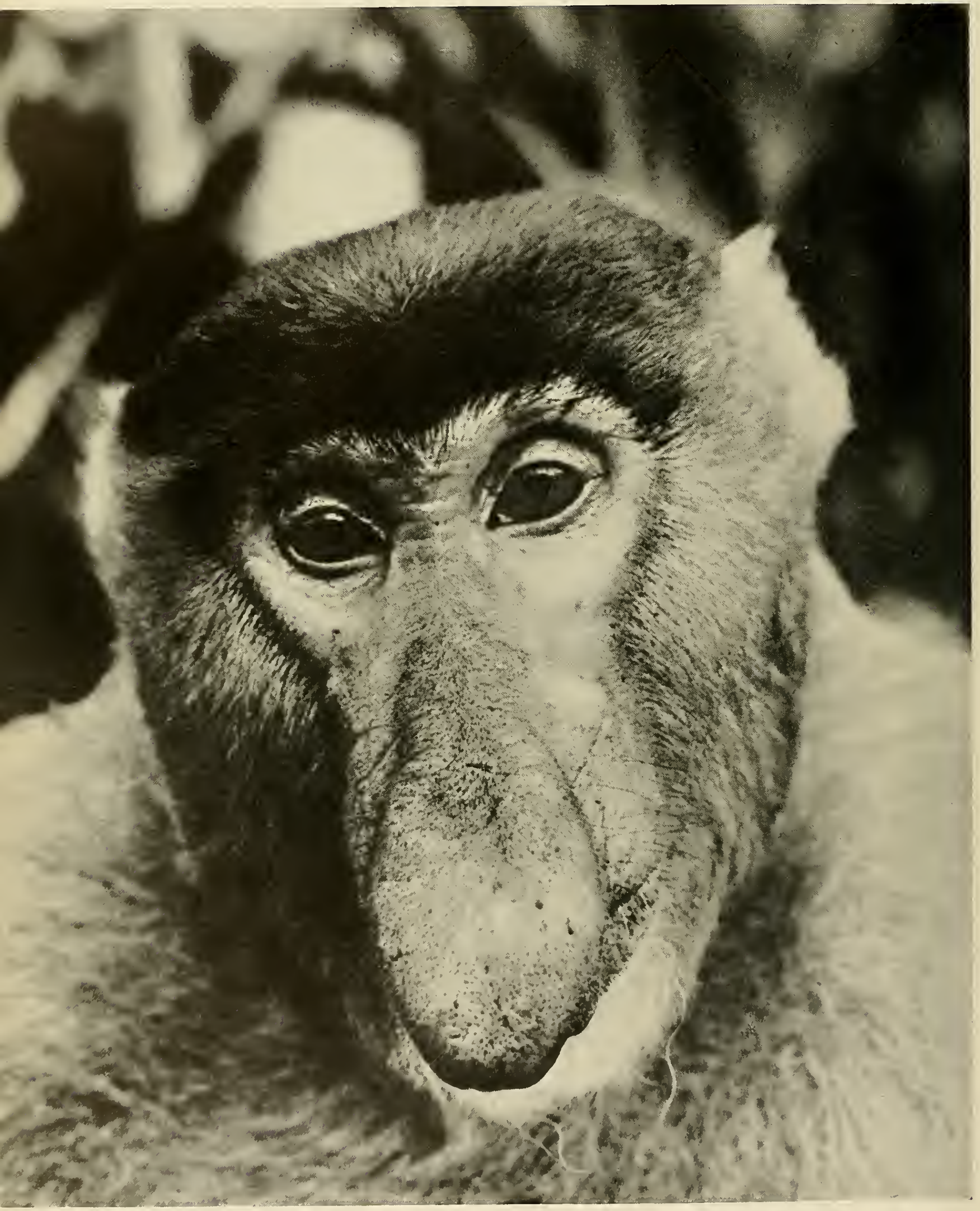
A photograph by Cornelia Clarke by Courtesy of Henry S. Conard



Seeing Nature

PROBOSCIS MONKEY

Photo by A. King



hrough THE CAMERA'S EYE

Photo by Fisher

DORMOUSE
at home in his
favorite tree

POLAR BEAR

Photo by Bird

The Evolution of an Evolutionist

Though indifferent to Nature as a boy, he grew up to become her ardent and untiring missionary as well as one of her most penetrating interpreters

By D. R. Barton

William King Gregory started out wholly unappreciative of natural history, as a printer's devil; and though he now has the unique distinction of holding two zoological curatorships—Fish and Comparative Anatomy—instead of the usual one, he began his Museum career humbly enough as the first editor of the periodical you are now reading. Typography and journalism were, however, merely two of several "wrong pews" in which he tarried for varying lengths of time before stumbling on his true vocation.

Forty years of uninterrupted Museum service to the contrary notwithstanding, his personal evolution was anything but a straight-line development. It would be pleasant to record that young William's interest in fish dates from the day he first angled with hand-whittled birch pole and bent-pin hook hard by a glistening country rill. But William was a city boy and he didn't care for fishing. Or birds. Or bees. Or flowers. He claims, indeed, that as a child he was singularly incurious about pretty nearly everything. ("At least," he says, "nearly everything I ought to have been curious about.") Yet when we turn the pages of the Senior Year Book of the Class of 1900 at Columbia University, we find that William King Gregory had by that time acquired a habitual curiosity about the meaning of things, which laid him open to this parting thrust by one of his classmates:

"More hows and whys can William
say,
Than the clock ticks minutes in a
day."

What caused such a transformation we cannot, of course, say for sure. But conversions of this sort are supposed to be the result of a slow fermentation within the individual's subconscious, which erupts without warning under proper conditions of temperature and pressure.

At any rate, William began his school days destined for the ministry but lived to create and preach a religion based on the scientific study of Nature. His primary education was entrusted by his mother to the New York Public School System until she read an account in the papers of a public school boy who had been blinded in one eye because a crony unexpectedly snapped a book strap at him. This incident preyed on her mind and shortly thereafter, when a furrier's son snapped a fox tail at young William's eye, she promptly transferred her boy to Trinity School.

Blackstone Photo

William King Gregory

William suffered from the incident neither physical disability nor mental perturbation, and it failed to rouse in this comparative anatomist of the future any curiosity whatsoever as to the internal structure of foxes or of the human eye. But it left him with the subconscious basis for subsequent belief in that theory of history which holds that the fate of individuals or of nations is determined by a series of accidents. However that may be, it seems clear that the accident of the snapped fox tail determined in part his subjection to the environment of Trinity School where he first struggled with Latin grammar to the tune of horsecars rumbling in the street outside.

Another accident

Before entering the printing business, Gregory Senior had made a living at tuning church organs and he joined his good wife in the hope that their son would take the episcopal orders. William had no reason not to acquiesce in their choice of calling. He was compliant by nature, he loved his parents, and, as it later turned out, possessed a certain latent capacity for evangelism. But with the passage of time he attained a profound interest in his family history, which caused him to look up a number of relatives whose inclusion within the bosom of the family would certainly have startled his immediate progenitors. It was his discovery of these relatives that caused him in later life to pen the following remarkably candid self-portrait:

"I undoubtedly inherit the general ground-plan of my face," he writes[1], "from my excessively remote shark-like ancestors who possessed paired olfactory capsules, paired eyes and paired internal ears, arranged in the order named, and who had a medium mouth below the nose and eyes. I also owe to these humble creatures the framework of my tongue and vocal organs, my jaw and throat muscles and many other features both useful and necessary.

"Next, I owe to the primitive lobe-finned fishes or crossopts the complete bony scaffolding of my face and jaws, which in them lay on the surface but in my own face is deeply buried beneath the flesh.

"Then I owe to the higher mammal-like reptiles the fact that the right and left halves of my lower jaw are composed of a single piece and that I have a set of teeth limited to the margins of the jaws and differentiated into incisors, canines, pre-molars and molars. I also owe to these hitherto much neglected animals the 'basic patents' for the delicate apparatus of my middle ear, together with my bony palate and several other important parts of my make-up.

---

[1] *Our Face from Fish to Man* (Putnam, 1929), p. 225.

"In the earliest mammals the bony mask became covered with mobile, sensitive flesh; to them I owe also the very hairs of my head, my eyebrows, eyelashes and other facial accessories.

"To my earliest primate ancestors I owe the large size of my eyes and a considerable part of my brains.

"To my friendly anthropoid ancestors I am heavily indebted: for eyes that can focus on things near at hand, that give stereoscopic pictures and that follow closely the flight of a moving object; for a nose that is a real nose and not a snout; for lips that can smile and laugh or curl up in anger or kiss in love; from them I inherited all my baby teeth and my thirty-two adult teeth; the very shape of my ears is theirs. . . . On the deficit side also there [is a] slightly warped septal cartilage of the nose, together with slight malocclusion of certain teeth and a failure of two wisdom teeth to erupt. Thus I can explain my face although I cannot improve it."

Fair enough. But it was for no such heady reasons as these that he digressed from the clerical path which his parents had mapped out for him. An "accident" intervened in the shape of a young lady. Her brother, William's closest friend at Trinity, aspired to become an electrical engineer. And William, sizing up the situation, saw no good reason why he should not suddenly develop a burst of enthusiasm for the same profession. The friend, naturally enough, was delighted with this new intellectual kinship and frequently invited William to his home.

However, it must not be imagined that this was a case of calculation in cold blood. William revised his entire curriculum and set about his unfamiliar tasks in good faith, plunging up to his neck in the practical sciences. Nor did he begrudge the tedium of nocturnal study or the odors of the chemistry lab. For was it not a labor of love?

But, despite the fact that his aptitude and perseverance won him a scholarship at Columbia, his interest in electrical engineering waned—(we have no way of knowing how much the "accident" had to do with this)—, and at the close of his sophomore year he laid his troubles before the dean. The latter encouraged him to make the difficult decision of abandoning engineering lock, stock, and barrel even though this meant the loss of all academic credits for two full years of work.

Still quite at sea intellectually, young William started all over again as a freshman in the old School of Arts, Columbia College. But when all seemed darkest came the glimmerings of a new day. A host of minor accidents apparently conspired to bring Gregory under the literary influence of a renowned philosopher and later under the personal spell of two great scientists. The literary influence came by way of Drummond's *The Natural Law in the Spiritual World,* a work which sought to resolve certain differences of viewpoint between religion and science. Some of these differences had already come to strife in Gregory's own mind, and *The Natural Law in the Spiritual World* had an effect upon him which was quite different from its author's intent. For it inflamed him with the idea of studying biology, a branch of science of whose existence he had previously been scarcely aware.

The masters

About this time, Henry Fairfield Osborn had vacated a chair in Comparative Anatomy at Princeton University to accept a Columbia professorship and, in addition, the task of creating a Department of Paleontology in the American Museum of Natural History. There already existed considerable co-operation between these two halls of learning, but with Osborn's arrival the bonds were greatly strengthened. Under Gregory this tradition of scholarly liaison work was later even further extended. But more of that anon.

Another zoologist of this epoch also held positions of importance both at Columbia and at the Museum. This was Bashford Dean, a man of astonishing versatility, whose scholarly attainments were expressed through a seemingly dual nature. Founder of the Department of Ichthyology and a zoologist of world repute, he nevertheless found time to establish himself as an equally eminent student of art. His lifelong interest in armor resulted in a collection which can be seen today on the other side of Central Park at the Metropolitan Museum, and he is probably the only curator in the history of either institution whose name will remain imperishable in both.

As for Osborn, the growth of the American Museum under his presidency is too well known to require mention here. But at the time Gregory switched to biology at Columbia, Osborn was still a young paleontologist for whom, as Gregory eventually wrote[2], "dry bones came to life and giant forms of past ages joined the pageant of the living."

Dean and Osborn were themselves giants, each in his own way, and it was under their care and nurturing guidance, first at Columbia and later at the Museum, that young Gregory grew intellectually to the point where both could bequeath to him the heritage of their professorships with the secure knowledge that the double burden would fall upon able shoulders.

One September morning in the late 1890's, Gregory wandered into Bashford Dean's lecture room for the opening class of the year. "A few minutes after Dean mounted the rostrum to lecture on the armored fishes of the Devonian age, I was caught," Gregory says. "In fact, I swallowed the whole thing hook, line, and sinker." No truer words could be spoken. His interest in fish has never wavered.

In due time Gregory became Dean's pride and joy. The latter encouraged his young disciple and even managed the establishment of a traveling fellowship in zoology in order to take him on a maiden collecting trip to California. His patient instruction bore fruit, and after graduation Gregory was appointed his assistant.

Meanwhile Osborn, whom Gregory still reverently calls "the Professor," had commenced to weave his spell. But it was not until he brought his young pupil to the Museum as librarian for his collection of paleontological papers that things began to happen.

Previously Gregory, under Bashford Dean's direction, had assisted the latter in rearranging and classifying the library of the New York Academy of Sciences and he was well equipped to undertake the Museum job which, incidentally, included the editing of the *Journal of the American Museum of Natural History*[3]. His work with Dean—whose study of the armored fishes jibed conveniently with his avocational inquiry into the development of human armor—had broadened his conception of the evolutionary principle. Yet, up to this time he had merely an academic interest in mammalian paleontology. Dissecting fishes and charting the developmental changes of a given internal organ were fascination itself. But bones were—well, just bones. At first Gregory listened only out of politeness when the Professor exhibited the fossil skull of some extinct rhinoceros and talked glowingly of the creature's erstwhile habits. The broad outline of this dusty science provided a useful background for the student of living forms, but Gregory was content to leave the particulars to others. Then presently he began investigating a few bones on his own, and a year or so later he published a bulletin on the "Adaptive Significance of the Shortening of the Elephant's Skull."

---

[2] Doctor Gregory is the official biographer of both Dean and Osborn.

[3] Later renamed NATURAL HISTORY Magazine.

He had snapped at Osborn's bait and soon was serving his two masters both at the Museum and at the University, where he later became Professor of Vertebrate Paleontology. Gregory feels greatly indebted also to the late Museum Curator of Paleontology, Dr. W. D. Matthew, who furthered his scientific development by means of many stimulating discussions. In 1906, Gregory was elected to the New York Academy of Sciences and, feeling his zoological oats, so to speak, flung himself on the abstruse and ticklish problem of the genetic interrelationships of the swarming families of the higher fishes. This was published by the Academy in 1907 and has been the foundation for all his subsequent studies on fossil and recent fishes. The next venture was his volume on *The Orders of Mammals* (1910), a work for specialists which he feels to be his magnum opus. "If anything I have written is going to be read 100 years from now," he says, "it will be that book."

However, some independent observers might take exception to this selection and rate Doctor Gregory's work on the history of dentition from the first appearance of teeth in the animal kingdom to the present, as of fully comparable importance.

Professorial curator

Weighty researches of this nature left him little time for field work. Next to Mr. Whitlock[4], Doctor Gregory ranks as the Museum's most sedentary curator and is far from being a ruddy, two-fisted explorer. Yet, even though the complexion of his entire career bears upon it the pale cast of thought, journeys to far-off places have by no means been excluded from his scheme of things.

Soon after he developed his belated passion for paleontology he made several field trips in the far west and, following World War I, he was dispatched in the company of his close friend and colleague Harry Raven to collect a representative series of Australian mammals, together with accessories for a proposed exhibition hall devoted to that continent. Then in 1925 he was invited by the New York Zoological Society to accompany William Beebe on the famous cruise of the *Arcturus* to the Sargasso Sea. This trip eventually resulted in the Hall of Deep Sea Fishes which stands today as one of the most impressive and unusual exhibits in the Museum.

In 1929 he took part in a joint expedition to Central Africa dispatched by Columbia University and the American Museum to secure and preserve the bodies of adult gorillas for comparative anatomical study.[5]

During the years when he was acting as assistant to Professor Osborn, Gregory was instrumental in planning exhibits in the halls of the Age of Man and of the Age of Mammals, each of which was made possible by researches conducted jointly by Osborn and himself. Recently, Doctor Gregory made a voyage to South Africa for the purpose of studying the fossil specimens of extinct man-apes described by Dr. Robert Broom. And two years ago he made a penetrating investigation of the shell forms which he collected on the beaches of New Zealand[6].

Thus it seems that for a boy who was so extraordinarily deficient in ontological curiosity, Doctor Gregory has done rather well in later years. His insatiable greed for understanding the reasons for things as they are, has led him into many lines of Museum activity and he holds titles, honorary or official, in the Departments of Fish, Comparative Anatomy, Paleontology, and Anthropology, as well as honorary degrees and memberships abroad. Actually he is listed on the Staff as Curator of Ichthyology and of the Department of Comparative Anatomy—the latter having split off from the larger specialty of Paleontology in 1921, when the need for laboratory research as distinct from field collecting became apparent.

A few years later, Bashford Dean found his health obliging him to withdraw more and more from his Museum work and he requested President Osborn to allow his erstwhile disciple formally to take over his department. The Professor acceded, and Gregory became the first dual curator in the institution's history.

In spite of his wandering in other fields, he remains true to his first love —fish—, partly because for him the phrase "from fish to man" implies a continuous study all along the evolutionary line and at both ends. His paramount ambition is to build bigger and better exhibits in the halls devoted to evolution. But he complains that, after he and his colleagues have perfected plans for installing exhibits to illustrate the most spectacular results of their research, there is often neither space nor funds available for construction.

He was therefore naturally elated when a few years ago Michael Lerner, the famous game fisherman, saw an opportunity to combine science and sport and accordingly launched a series of expeditions to many parts of the world which are yielding a steadily increasing harvest. One of the evidences of this activity is seen in the newly installed exhibit "Game Fishes of New Zealand" and in a growing array of scientific reports on this and related material.

Though handicapped by a slim budget, the Fish Hall abounds in exhibits of dramatic beauty and educational clarity, although some might feel that Doctor Gregory's gratitude to the sharks for their contributions to his face has prompted him to display these creatures in a profusion suggesting ancestor worship of the most idolatrous sort.

When it comes to comparative anatomy, "No one," he laments, "seems to get very enthusiastic about a thing like the history of the dentition. You couldn't name a more important phase of evolution but it simply has no romantic appeal." Nevertheless, dentists and other students of teeth all over the world are using the books and papers on this subject written by Doctor Gregory and his collaborator, Dr. Milo Hellman.

If Doctor Gregory's Department is short of cash it is certainly long on brains. By extending the co-operation between the Museum and Columbia, initiated under Osborn's regime, he has given the former institution the benefit of an imposing bulk of research work, done free of charge in exchange for the use of scientific collections. The workers, in this case, are his students who have been drawn to him from all over the world and who know and love him not only as a teacher but for his unsparing devotion to science and for the fact that he leaves no stone unturned in his unusually successful efforts to place all of them in congenial positions on the faculties of leading colleges and universities throughout this country and abroad. Indeed, as a teacher he has influenced many Museum careers, several members of the Staff being graduates of Doctor Gregory's course in the development of the vertebrates.

---

[4] See "Keeper of the Gems," by D. R. Barton, NATURAL HISTORY, October, 1940, p. 177.

[5] The story of this expedition is told in *In Quest of Gorillas*, by William K. Gregory and Henry C. Raven (The Darwin Press, 1937).

[6] See "An Evolutionist Goes Shell Hunting," by William K. Gregory, NATURAL HISTORY, November, 1939, p. 203.

Out of this widely distributed bumper crop, Doctor Gregory hopes to see a new generation of inspired teachers arise to enlarge and disseminate knowledge of the history of life on earth. In great teachers and in the inquisitive students of future times, he places his faith, for he well knows the value of this happy combination in his own life.

Thus the boy who was indifferent to natural history lived to smite his lyre in her behalf:

> "Oh let us give praise unto Natural History: for she hath revealed the splendor of the heavens.
>
> . . . .
>
> "The chronicles of the ages are here; the generations of living things are numbered in her book; the records of their origins are graven upon her tablets . . ."

And the boy who foresook ecclesiastical orders for those of mammals and other creatures living and dead, grew up to preach the gospel of science:

> "If an evolutionist ever felt impelled to make a prayer, he might well pray somewhat as follows:
>
> "Behold, O Lord, man vaunteth himself foolishly and is puffed up in vain; seeing that he is but a scion of the apes and a descendant of them that dwell in the branches.
>
> "Yet hast Thou taken pity upon him; Thou hast raised him up on his feet and exalted him above his fellows.
>
> "But his pride hath been his undoing; his wickedness is the cause of his downfall.
>
> "The Magicians pipe and the multitudes dance; false prophets arise and lead the people into foolishness.
>
> "Save us, O Lord, from their machinations; help us to resist their power with stout hearts and to confute their magic with our understanding of its vanity.
>
> "And they that deceive the people with witchcraft shall be driven forth out of their holes; and our young men shall slay the giant Superstition with the pebble of Science.
>
> "Above all send us teachers, O Lord, who shall teach wisdom to the young and understanding even to the babes and sucklings.
>
> "So shall our youths and maidens behold the everlasting power of Thy works, and the infinitude of Thy creation.
>
> "And they shall proclaim a new vision of holiness and a message of salvation to man."

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INFORMATION TEST

A few informational high spots that may be gleaned from this month's NATURAL HISTORY

Correct answers on page 244

1. If all the diamonds in the world disappeared, why could not the ruby serve as the standard engagement ring?

2. Are there any fossil jellyfishes?

3. Pumice is:

(a) Petrified sponge
(b) A coral formation
(c) Solidified lava froth

4. Is it possible to mistake a diamond for both a ruby and sapphire at the same time?

5. Diamonds can withstand the blows of a blacksmith's hammer.

True........ False........

6. The largest man-made structure ever conceived is:

(a) Empire State Building
(b) Pyramids of Giza
(c) Grand Coulee Dam

7. Its temple is as tall as the Cathedral of Notre Dame, its people created one of the great civilizations, its ruins are hidden in the jungle, and modern armies threaten to fight over its territory. What is it?

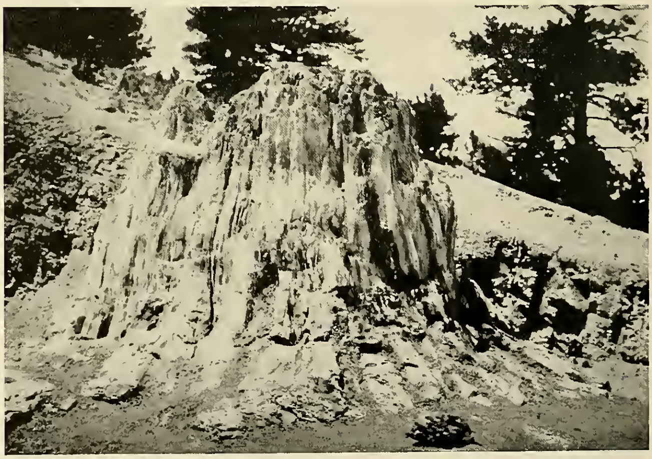
8. A box full of sand will weigh more than the same box full of marbles.

True........ False........

9. Name the only gem stone that is composed of a single element.

10. What is the object illustrated below?

ANIMAL, VEGETABLE, OR MINERAL? A distinctive photograph of one of nature's wonders, submitted by Pearl M. Maus. (Answer on page 244.)



Controlling Color in Kodachrome

By CHARLES H. COLES
Chief Photographer, American Museum of Natural History

PHOTOGRAPHY in color has become so popular these days that the scientist, amateur and professional, is using it more and more to make records of natural science phenomena. The addition of color to photographic records has made them ever so much more attractive as well as useful. Marvels of chromatic brilliance grace the screen of many a lecture, and we are beginning to regard a lecture as dull if it does not have slides or films in Kodachrome.

Along with the widespread use of color film has come a finer appreciation of good color rendition and pictorial composition. No longer does mere color evoke the awe it formerly did. Anybody can make color pictures today, and only excellent color and good composition attract attention now.

Faults of color photography

One of the first lessons learned about Kodachrome is that it has no subjective reactions. What it sees is not colored by previous knowledge or experience. When the color film sees grass, it doesn't insist, as we are so apt to, that all grass is green. It may see brown grass or blue grass or other colors that look all wrong to us in the processed film.

You have probably observed the cold, gray dawn of a winter's day. If you look at a snowbank through a window of an electrically lighted room, you will see that the light outside appears to be a deep blue. As soon as you step out into the open, however, the blue disappears and the world looks gray and drab. A Kodachrome taken before sunrise will exhibit a brilliant blue tone, proof that blue was the actual color of the light on the snow.

On a cloudy day during which no sunshine can be seen, blue light predominates. Kodachromes made on a cloudy day show a bluish cast that throws most colors too much toward the cold tones. Pictures of leaves, lichens, insects, animals, or any other outdoor subject taken on a cloudy day are far from truthful records of what we saw.

Correcting Kodachrome's vision

Although many photographers don't like to bother with filters, their objections ought to be quickly overcome by the tremendous improvement in color rendition. When you have made a special trip to get some color pictures of a specimen and the day suddenly turns cloudy, you will thank your lucky stars that you have filters to offset the changed light quality.

The first filter that you need to make Kodachrome see things your way is a Wratten 2A. This is a very faint yellow filter, but its effect upon Kodachrome is much more drastic than the delicacy of its tint would indicate. The secret of its power lies in its treatment of the ultraviolet light which, although invisible to the eye, affects the Kodachrome film strongly. This filter is the one to use for all subjects taken either on a cloudy day or in the shade on a clear day. The 2A filter eliminates the ultraviolet light and with it the bluish appearance of a subject which, while actually present, we completely ignore visually. Our brain tells our eyes that there is no bluish cast. We must tell the Kodachrome the same thing by using a filter. No increase of exposure is necessary.

The 2A filter is also useful in overcoming the blueness of the light from flash bulbs when used indoors with Kodachrome *A* or *B*.

The polarizing filter

We see and photograph all objects by means of light reflected from them. This reflected light consists of two parts: the surface reflection which retains the color of the light source, and the remnant of the light which has penetrated the surface of the object and has become colored by it.

Look at a glossy leaf carefully. Part of its color is due to the blue of the sky which it reflects, while part is due to the green color of the leaf itself. If you were to make a color picture of this leaf, the finished film would show a leaf bluer than it actually was because of the sky reflection. This surface reflected light dilutes the color of many objects, even rough-surfaced specimens, so that it is very difficult to obtain true color.

When a photographer is bothered with reflections on the glass of a store window, he pulls out his polarizing filter, slips it over the lens, rotates the filter until the reflection disappears, and then makes his picture.

Borrowing this trick, we can put a colorless polarizing filter over the Kodachrome camera lens, turn it until the sky reflections disappear from our leaf surfaces and then make our picture. Thus, pictures of trees look far better because of the improved rendering of the green leaf color. An amazing revelation will come when photographing a cornfield. The corn leaves change from bright blue to dark green as the polarizing screen is rotated before your eye. Clip it to your lens in its most effective position to reproduce the true leaf color.

Because the polarizing filter throws away the light from the undesirable reflections, an increase of exposure is required—about double the normal—to compensate for this loss.

We photographers are now beginning to learn how to see color and can critically view our efforts at recording it, and the inaccuracies of our vision are becoming apparent. So when we do not get perfect color photographs, it is well for us to ask whether the reason is not perhaps in ourselves rather than in the film.

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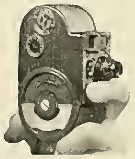

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INDIAN ART OF THE UNITED STATES

- - - - - - by Frederic H. Douglas
and René d'Harnoncourt

The Museum of Modern Art, New York
$3.50

INDIAN ART OF THE UNITED STATES is the catalogue of the current exhibition at the Museum of Modern Art. It is far more than a guide; it is a fully documented survey of the whole subject of North American art by two of the greatest authorities on the subject. Mr. Douglas has done splendid work as Curator of Indian Art at the Denver Art Museum, and Mr. d'Harnoncourt who has long been interested in contemporary Indian affairs in Mexico and the United States, is now General Manager of the Indian Arts and Crafts Board of the U. S. Department of the Interior. Therefore, both are peculiarly fitted to make this vital and constructive presentation of Indian Art in the past and present. Whether or not the reader has visited the exhibition, he will find in this text and its lavish accompaniment of well selected illustrations, a most impressive book on art and life among our Indians.

The authors open their book with an Introduction covering tribal traditions and progress, general comments on Indian art, and Indian origins and history. Then follow a section on color, and a division devoted to the prehistoric art of the carvers of the Far West and the Northwest coast, the engravers of the Arctic and the sculptors of the East, closing with the painters of the Southwest. They make their divisions in terms of the type of art rather than according to archaeological nomenclature.

A chapter on pictographs comes next; then a long section on the living artistic traditions of modern tribes, which are described in terms of the manner of life of the makers, since tribal names do not have so clear a meaning for the casual reader. The last part of the book is devoted to Indian art adapted to modern living, accompanied by an adequate bibliography arranged for nontechnical interests.

The splendid text, rich illustration, and low price make this a book for ownership, not library consultation. Our growing interest in things American will find satisfaction in this splendid volume by two authors who illumine their great knowledge of Indian art with a profound understanding of Indian life.

GEORGE C. VAILLANT.

STUDIES IN AMERICAN DEMOGRAPHY

- - - - - - - - by Walter F. Wilcox

Cornell University Press, $4.50

"PROGRESS," declares Professor Willcox, "is movement or change toward a limit." For the demographer it is the changes, adaptations, and integrations of a population in statistical terms. In this sense, then, the progress of the United States serves as the major theme for *Studies in American Demography*. From among his varied population papers, Professor Willcox has selected twenty-odd studies which deal with various tests of our national progress. For example, the increase in length of life, the growth of population, birth and death rates, classifications by residence age, sex and marital condition, literacy and various other criteria are examined minutely and critically for trends in national development.

Professor Willcox is one of the leading demographers in this country and out of the rich harvest of a fruitful professional life he presents this omnibus volume. It is full of pregnant observation and stimulating suggestion, and although written in the first instance mainly for professional readers it contains much of value for others as well.

H. L. SHAPIRO.

OUR TREMBLING EARTH

- - - - - - - - by Joseph Lynch, S.J.

Dodd, Mead, $3.00

A POPULAR discussion of earthquakes and seismology seems to be a very difficult task, but we could ask no greater authority in this field than Father Lynch. It is fortunate that we should have a readable work on the subject by so eminent a scientist. Too many popularizations of science are written by authors with naught but a facile pen.

The book tells what earthquakes are and what causes them. It describes the instruments which record them, with special reference to Father Lynch's own observatory at Fordham, discusses the distribution of seismographs over the world and tells about the organizations which assemble the data on each earthquake. Earthquakes at varying distances and the different kinds of waves recorded for those distances are shown, an explanation is given of the means by which the observer can tell from a complete record the approximate direction and the exact distance of the slip from the station. And all of this is done without the complicated formulae which usually scare off the non-mathematically minded reader before he reaches the first P wave.

The work is excellent and authoritative but, in common with most scientists, Father Lynch finds it difficult to write for the popular public. So many explanations are needed; but he does not seem always to have chosen the most propitious time for his detours. With hundreds of Jamaicans lying dead on the ground, we discuss the height of a top hat, and as Japanese villages topple like cards, we hear about tides and tsunamis. In "The Value of Seismology to Geology" we read principally about Father Lynch's ingenious new theory of the state of the core of the earth, but find no suggestion of the many zones lying between it and the crust.

F. H. POUGH.

BEHIND GOD'S BACK

- - - - - - - - - - - by Negley Farson

Harcourt, Brace, $3.50

ONE of the great prizes in the present war is Africa. God may seem to have turned His back on it, for a large part is unsuited to permanent white settlement; but it offers a vast field of exploitation. In the last year before war, Negley Farson traveled over wide stretches of South Africa, and then with his courageous wife crossed from East Africa to the Belgian Congo and the Cameroons. Finally, on the Gold Coast, he fell in with an earthquake. Two months later the upheaval in Europe commenced.

The whole tour occupied only seven months, but Farson is uncommonly quick at recording real political conditions. What he found in some areas was hair-raising. For the African native he has intense sympathy, a feeling notably lacking in white men who go to Africa to feather their own nest.

In colonies with bad climate and dense black population the native is apt to be well treated. When labor is scarce he may be exploited financially yet otherwise protected. Where white settlement is easy, the native is usually oppressed. Nationalistic rivalry among whites causes severe tension, and Indian immigration has added another immense difficulty. Territories under mandate of the League of Nations were conscientiously administered. On the whole, concludes Farson, English rule in Africa gives the native the best chance of progress, despite inefficiency in economic planning.

The book leaves much to be desired

when fauna and flora are described. Its author is a sportsman, and hunted lion and buffalo, sparing most other game except waterfowl. But Muscovy ducks do not occur wild in Africa, marabous are not cranes, and his toucans should be hornbills. Mahogany and ironwood are not the main constituents of the Congo forest, and tapioca is only a finished product from the manioc root.

To call attention to such errors is almost unfair. We have here a most exciting report on conditions of tremendous import to a widespread and cantankerous mammalian species—man himself.

James P. Chapin.

THIS IS OUR LAND

- - - - - - - by E. G. Cheyney and
T. Schantz-Hansen

Webb, $3.00

THE authors have written a book designed to teach the young people of this country the significance and vital workings of their heritage in this continent. First is described the promise and wealth of the land before the unbalance caused by our civilization. Then follows a description of the spectacular abuse caused by the heedless ignorance of the people who developed the land and resources. After the description of each misuse, the writers tell what is being done to remedy the condition and suggest what further can be done.

The book is generously illustrated with well-chosen pictures that demonstrate each point. At the end of each chapter are 20 review questions, a group of about ten suggestions for correlated activity on the student's part, and a subject for debate on the contents of the chapter.

The text is written to make the material interesting and challenging to the student. The questions and suggestions are of great assistance to the teacher. It is a book that should be studied in all schools that are interested in their pupils as citizens—not as mere receptacles of unrelated facts.

John N. Carley.

MAN'S FIRST MILLION YEARS

- - - - - - - - by Jannette M. Lucas

Harcourt, Brace, $2.00

MISS LUCAS, who for many years has been associated with the American Museum, has here attempted a simple, easily-understood account of the history of man's physical evolution and of his early cultures. It is a short book, written in a frankly popular vein, and is obviously intended for the layman or as a young student's introduction to this most fascinating and significant field.

The book contains a brief account of mammalian evolution as it led toward man, and in the order of their actual appearance, discussions of each of the most important fossil men,—Java Man, Peking Man, the Neanderthals, etc. Coupled with this are descriptions of each of the major stages in the progress of man's cultural development throughout the Stone Age. This method of presentation is an admirable feature of the book, skeletal remains being considered wherever possible in conjunction with their respective cultures and thus clearly indicating the related progress of both. Included are a chart showing the correlation of men and their cultures with glacial movements, and a fair number of drawings of artifacts and of reconstructions of early types of man.

The book suffers somewhat from inaccurate phraseology which in several instances, I think, might confuse the beginner. Also, perhaps, there is some unwarranted speculation in regard to such things as the mental processes of early man, more permissible in a popularization of this kind than in a scientific work, but giving the impression of being a bit too "popular" at the expense of accuracy. Remembering, however, that the subject dealt with is extremely complex and difficult to state in simple terms, it is clear that this book is a definite contribution to the popular literature on the subject.

G. F. Ekholm.

PEACOCKS AND OTHER MYSTERIES

- - - - - - - - by Jean de Bosschère,
translated from the French by
Frederick S. Hoppin

The Brick Row Book Shop, New York,
$2.50

ALL life is mysterious, and to one who loves birds in the mystical fashion of Jean de Bosschère, peacocks are particularly puzzling. The first half of this little book discusses the ways and the gorgeous plumage of peacocks which he kept on an estate in the Land of the Blue Thrush, as he calls the Roman Campagna. Its second half is a collection of nine essays in which we learn to know the author intimately, for he tells us of his early love of birds, his remorse in boyhood at causing the destruction of a lark's eggs, his acquaintance with bird fanciers, and his own passion for living birds. Yet the deep sorrow at having harmed a bird continues throughout his manhood.

This is literature in the best French manner, rather than ornithology, and the author is exceedingly sensitive. Though deeply shocked by his neighbors' treatment of birds, whether domestic or caged, he cannot help loving these human tyrants as much as he does their victims. His greatest admiration, naturally, goes to kindly men who, like Saint Francis of Assisi and the poet Miloz, could attract birds without doing them harm.

The peacock never departs from a formal almost conventional gravity, observes de Bosschère, and appears to suffer from nostalgia, if indeed he is not a confirmed hypochondriac. He has the wings of an angel and the voice of a devil. His delicate chicks give notes that suggest a broken-hearted flute, and they look, we are told, very like diminutive ostriches.

Other topics briefly discussed are the reactions of chickens to their first snowfall; the behavior of a guinea chick hatched with a brood of ducklings under a hen—it actually followed them into the water just once; the "bootlegging" of native cage-birds in Paris; and pigeon racing for sport in Belgium. Interest in birds expresses itself in many and devious ways, and here is a book that proves it.

James P. Chapin.

FAMOUS MEN OF SCIENCE

- - - - - - - - - by Sarah K. Bolton

Crowell, $2.00

THIS is the eighteenth printing of a book which was first issued in 1889. The present edition has been enlarged by the addition of a chapter on Luther Burbank. It is a work composed of short biographies of Copernicus, Galileo, Newton, Linnaeus, Herschel, Cuvier, von Humboldt, Davy, Audubon, Faraday, Lyell, Agassiz, Darwin, Pasteur, Fabre, Kelvin, Edison, the Curies, Marconi and Burbank.

Such subjects make for dramatic reading and the author has done full justice to her subject. The inclusion of so many studies in one book requires a great amount of condensation. At times the subjects neglected were of much greater importance than those included. As a specific example, no mention is made of the publishing of the tenth edition of Linnaeus' *Systema Natura,* the basis for all modern taxonomic studies, and the work itself receives mention only once—and then only of the difficulties in publishing it. There are some completely inaccurate statements, though these are generally of minor importance. Paleontologists, for example, will be surprised to learn (p. 253) that *Archaeopteryx* was found in England. And it is difficult to understand (p. 5) how Aristotle "had contrived" to get his "strong beliefs backed by the Roman church."

Henry W. Longfellow wrote:

> "Lives of great men all remind us
> We can make our lives sublime,
> And departing, leave behind us
> Footprints on the sands of time."

Mrs. Bolton seems to have been fully conversant with this thought. This book was first published in 1889, and in many places has a truly Victorian style, which is generally pleasant, but at times the author strives too hard to point the moral.

All these criticisms are of essentially minor importance, and the book itself remains pleasant and profitable reading.

H. E. Vokes.

JOHN KIERAN'S NATURE NOTES

Doubleday, Doran, $2.00

THOSE who listen to "Information, Please" and those who read the sports columns of *The New York Times* will be interested to learn that John Kieran has put into book form some of his observations of the fields and woods—dragged out of him, as he says, by Colonel Theodore Roosevelt. Thirty-six very short essays—we wish they were longer, about "common trees, common birds, common animals, and common flowers" make up the little volume.

This versatile man with the superhuman memory is a naturalist of the Burroughs school, and like all true lovers of nature he has put himself into his book. In the foreword he says, "I can truthfully and sincerely set it down that hours, days and years in the field with these common friends were filled with quiet and ever-growing delight, and the things they taught me have left me humble, hopeful and grateful."

Among the numerous fascinating stories of nature, he has included how the witch hazel shoots its seeds, how the domestic pigeon drinks, how the turnstones got their name, how a polar bear swims, and the dramatic story of the Sea Gull Monument in Salt Lake City—how Franklin's gulls saved the lives of the Mormon pioneers. He writes of our smallest bird, the hummingbird; of our largest animals, the whales; of our largest trees, the sequoias; and of many creatures of average size. The reader will be amused by the decisive way in which he disposes of the popular belief that rattlesnakes, prairie dogs, and burrowing owls live together in harmony.

One may doubt the theory he accepts of why long-billed marsh wrens build extra nests. But all will find this little book a welcome relief from the turmoil of a troubled human world. CLYDE FISHER.

A TEXTBOOK OF ZOOLOGY, VOL. II (VERTEBRATES)

by T. Jeffery Parker and William A. Haswell

Revised by C. Forster-Cooper

Macmillan, $9.00

AMONG a throng of zoological textbooks "Parker and Haswell" is unique, and only British conservatism can explain the use of its old and unpretentious title for this essentially new manual of animal anatomy and relationships. The true lover of natural history, no less than the earnest student, eventually reaches a point where he is no longer satisfied with elementary and superficial books but wants clear, authoritative information about a thousand details of animal structure and history. Then he will turn with confidence and pleasure to this book, whether he wishes to study it systematically or to use it as a reference work to clear up specific points. It is technical in that it employs exact scientific terms rather than popular approximations of them, but its explanations are lucid and are accompanied by a wealth of clear illustrations.

The format and much of the text are entirely new, but well-tried features of the old "Parker and Haswell" are retained and brought up to date. Representative animals, chosen as far as possible so as to be available for firsthand observation by the reader, are described in detail, with adequate summaries of the peculiarities and variations of their relatives. Notes on classification, relationships, distributon, and habits are shorter but adequate for general purposes.

An outstanding feature of the revision is the inclusion of excellent brief discussions and many illustrations of fossil vertebrates, so that the animals of today are seen in true historical perspective. The unusually clear and full Index makes any detail quickly available and greatly increases the usefulness of the book.

This volume is of basic importance for any working library of natural history, whether amateur or professional.

G. G. SIMPSON.

CANNIBALS AND ORCHIDS

by Leona Miller

Sheridan House, $2.75

IN New Guinea there are still blank spots on the map where no white man has been and where natives carry on their daily lives by Stone Age methods, ignorant of or ignoring the white man's civilization and his government. Such is the unusual setting for Mrs. Miller's story of adventure, which has for its framework the trip into the interior of Netherland South New Guinea that her husband Mr. "Cannibal" Miller, described in *Cannibal Caravan* two years ago. But this is the primitive as seen through a woman's eyes, and a woman's reaction to it. The matter-of-fact recording of the fear experienced on seeing a huge reptile; her husband inheriting a chieftainship by killing the chief and then participating in a head-hunting, cannibalistic raid; witch doctoring, birth, drunken orgies, free love, sudden death and the offer of a native to buy the authoress from her husband are breath-taking or amusing, depending on your point of view. The tale never lags, is cleverly written, and makes good reading.

Local color is carelessly put in: there are impossible ptarmigan, toucans, humming birds, and vampire bats; the "Tertiary period, with its dinosaurs, giant turtles and scaly monsters" is said to persist; the descriptions of the country and customs are vague and unconvincing.

A. L. RAND.

LIONS ON TRUST

by Cleland Scott

The Macmillan Company, $3.00

ONE would hardly consider lions as ideal household pets, but Mr. and Mrs. Cleland Scott, who own a ranch near Nanyuki in Kenya Colony, British East Africa, find them most interesting, if not ideal. The Scotts have had about a dozen lion cubs in their home at one time or another, the most entertaining being Romeo and Juliet. These last were purchased as small cubs from the zoo in Nairobi. At the time of the writing the cubs were over two years old and weighed about 300 pounds each. As one can easily imagine, such animals in a home were not too considerate of household belongings and many accidents occurred. But as Mr. Scott puts it, "You must expect such things if you keep lions as pets." Another fact that Mr. Scott points out is that it is difficult to keep poultry and stock as well as to remain on the best of terms with your neighbors if you wish to keep lions. Mr. Scott prefers the lions.

Not only is Mr. Scott interested in lions as pets but he has spent much of his time in the field hunting and observing wild lions, and a number of chapters are taken up by his experiences. On one occasion, early in his career, he was badly mauled by a wounded lion. Even this did not alter his affection for them. Mr. Scott is also a professional hunter, and parts of the book relate his experiences with big game hunters and photographers.

There is one statement made to which I must take exception. Mr. Scott writes that the cheetah is not a cat but is related to the dog. It is true that, with its long legs, slim body and nonretractile claws, the cheetah resembles a greyhound. These are factors for great speed, and the cheetah, for a short distance, is the fastest of running mammals. It is, however, a true cat of the family Felidae, as can easily be seen by skull characters.

This book is different and makes interesting reading. The numerous photographs of lions out of their natural habitat form one of its chief features. T. D. C.

JOURNEY TO THE WORLD'S END

by Hakon Mielche, translated from the Danish by M. A. Michael

Doubleday, Doran, $2.50

MR. MIELCHE'S trip to Tierra del Fuego was made solely for the purpose of getting material for this book. His story is well and amusingly written as long as he holds to the account of his own adventures. However, when he tries to describe the country and its people, numerous unfortunate errors occur. In view of the fact that the manuscript was on its way to the publisher within twelve weeks after his arrival at the Straits of Magellan, this is not surprising.

Some of his criticisms of the way in which the sheep farming region has been settled and managed are unwarranted. For instance, he claims that forests have been destroyed to make grassland in a section which has seen no trees since the last ice age, and cites this as proof that the land is wastefully exploited! He is also confused in his use of certain geographical terms.

While taking exception to some of his comments it is also necessary to protest his portrayal of Fuegian weather. It sounds very much as if he were trying to satisfy the expectations of his readers when he writes that it has "one of the coldest and severest climates in the world," and of monthly temperatures "well below the freezing point" the year around. This might be true if applied to Fuegian mountain crests lying above the line of perpetual snow, but such statements are no more accurate than they would be if used in speaking of the climate of Mexico or Switzerland.

Also misleading are his remarks on the present and former Indian population, particularly the references to the Alaculuf tribe.

It is a pity, in view of Mr. Mielche's ability as a writer, that he has not been more accurate. JUNIUS BIRD.

Continued from page 182

SIRS:

The article "Canine Fishermen" by E. W. Gudger in the last issue was most interesting to me, as I am sure it was to your other readers. An unusual subject told with clarity and vividness, and well illustrated, is a recipe for successful writing.

Permit me to suggest that other articles along the same line would probably be welcomed by your subscribers.

JAMES R. DANIELS,
Associate Editor.
Sales Management
New York, N. Y.

* * *

SIRS:

Most of the readers of NATURAL HISTORY Magazine have probably never seen a fossil of a jellyfish and may be surprised to know that a record of this most delicate creature of the sea could be preserved in the rock for 80 million years.

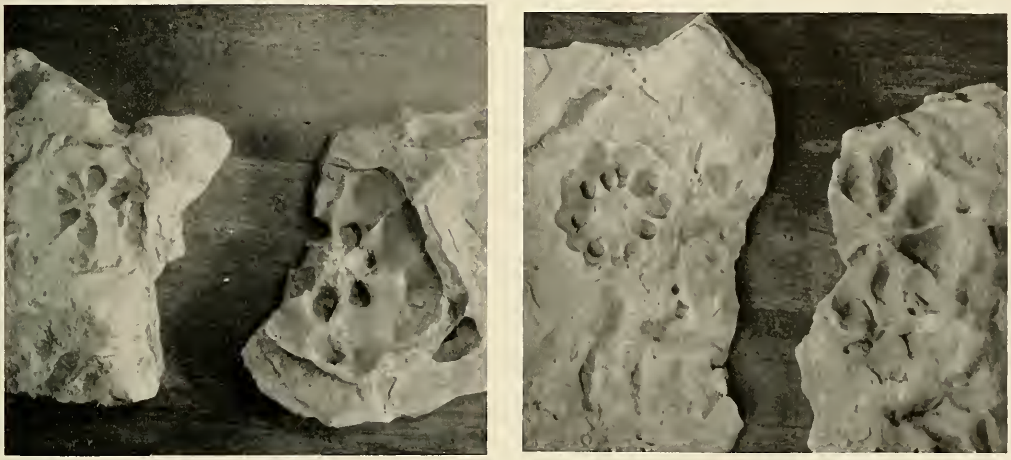
On one of our usual week-end exploration trips, my wife and I discovered our first specimen of these rare fossils, more than six years ago. It resembles a deep imprint of a large seven-petaled blossom. It was something new to us, entirely different from any fossils described in the literature which we had on Texas paleontology. We soon guessed that it was the outline of a jellyfish, although different from any jellyfish we had ever seen. When I sent samples to Dr. R. S. Bassler of the United States National Museum, he stated: "This is a very interesting fossil, and you are quite right in believing it is a jellyfish. It represents the imprint in sand of a fossil jellyfish, but its more definite classification cannot be given until a detailed study of such forms has been made. In Europe fossil jellyfishes very similar to this have been described from the celebrated Solenhofen lithographic limestone of Jurassic age."

The time when these creatures lived was more than 80 million years ago, the Age of Dinosaurs, when most of Texas was covered with the shallow Comanche Sea. Apparently the fragile jellyfishes were washed ashore by the tide and, being covered by sand or soft mud, left their impression in the material which later became rock.

The area near Roanoke, Texas, where we found these is only about three miles long and less than one-quarter mile wide. The fossils are extremely rare, and one must examine the sandstone slabs carefully on both sides to find them. The imprints vary in size from one inch to four and one-half inches; and the number of lobes around the center varies, with seven about the average. There are two types: one with a single row of lobes, the other a double.

All the prints seem to show the lower side of the animal, and the question therefore arises: why did none of the animals come to rest on their backs when they settled into the mud? This is only one of many questions about these fossils, but it is the thrill of discovering and attempting to read these stories in stone that makes fossil-hunting one of the most fascinating of outdoor hobbies.

FORREST KIRKLAND.
Dallas, Tex.



WHY NEVER ON THEIR BACKS? *(Above)* Fossil jellyfish estimated to be 80 million years old *(Below)* The place where they were found near Dallas, Texas

Photos by Forrest Kirkland

THE SOCIAL RELATIONS OF SCIENCE

- - - - - - - by J. G. Crowther

Macmillan, $3.50

SCIENTISTS do not and never did live in ivory towers. The long, interwoven histories of science and of society, skillfully expounded in this book by the scientific correspondent of the *Manchester Guardian*, show that social factors have determined not only the rate but also the direction of scientific progress, which in turn has a profound influence on social evolution. The present age is characterized both by the cultivation of science and technology and by the intensification of social consciousness and change. No book could be more timely than this, relating the two outstanding phenomena of modern civilization and tracing their parallel development from prehistoric times.

The influence of society on science has usually been restrictive and conservative, that of science on society expansive and progressive. Crowther demonstrates a correlation between the social status of skilled manual labor and the development of science. In a society based on slave labor, intellectual endeavor is barren, science hardly exists, and technology stagnates. As the social appreciation and reward of skilled labor increase, science flourishes and technology advances. The social change favorable to it is accelerated by science which thus tends to improve the status of skilled labor. The process is not without exceptions and it is self-limiting, because it often tends toward a type of social control unappreciative and uncongenial with regard to science, in spite of its basic interdependence with science. Science is not productive in an immediate and material sense, and it requires the use of surplus production from the material producers. When the support is either indirect or compulsory, other things being equal, scientific movement is mainly controlled by scientists and history shows that such control has been justified, on the whole, by ultimate increases in production and in social well-being. But as science becomes dependent on the direct and voluntary support of the great producing masses, it also becomes subject to their control and to their scale of values, which is often inimical to science. This situation is rapidly arising in America and must inevitably arise as a democracy evolves beyond its plutocratic stage. For us the problem is very real and present and in no sense academic.

The obvious, indeed the only, solution is a realization by those in control that their own welfare (both material and cultural) depends on science. Crowther's history demonstrates the necessity of this solution and is a contribution toward that end. The average skilled workman, himself a technician, thinks of technology as "useful science" and of science, properly speaking, as "useless science." He favors the support of technology and thinks of this as contributing to the advancement of science, while he may in fact be not merely indifferent but openly antagonistic to such advancement in a truer sense. This confusion of values is conveyed to his leaders and representatives, often in exaggerated and still less desirable form, because appreciation of technology is at least fertile soil for the growth of science but the current form of political representation usually understands neither technology nor science. Science and technology are so inseparably related that the confusion is natural, but just because of the intimate relationship the result of depreciating "pure" science may be fatal not only to science but also to technology. It is a fault of many recent popularizations that most of what they call "science" is really technology. Unfortunately Crowther's book, despite its general excellence and the value of its contribution to this whole problem, sometimes has this fault. It properly discusses the social history of both science and technology, but it fails to make a consistent distinction between them and often means "technology" when it says "science."

The book closes with some discussion of recent efforts by scientists to co-ordinate society and science and has a final minatory chapter on the social responsibilities of scientists. Elsewhere it is made sufficiently evident that the responsibility is mutual. In a book intended primarily for nonscientists, final emphasis on the scientific responsibilities of society would have been more original and more useful. Not the least of the many good qualities of this highly recommended book is that it stimulates thoughtful discussion and presents the materials for informed opinion, whether or not in full agreement with the author.

G. G. SIMPSON.

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Answers to Questions on page 238

1. Diamonds are among the commoner gems; no other precious stone is found in sufficient quantity to serve as a standard engagement ring. See page 211
2. Yes. Fossil jellyfishes have been found whose age has been estimated at about 80 million years. See page 243
3. (c) Solidified lava froth. See page 204
4. Yes. Certain very rare diamonds are ruby-red, and all rubies are scientifically regarded as varieties of sapphire. See page 211
5. False. Diamonds have an excellent cleavage and can be crushed as readily as many other stones. See page 211
6. (c) Grand Coulee Dam. See page 210
7. The Lost Empire of the Khmers in Indo-China. See page 213
8. True. See page 211
9. Diamond. See page 211
10. The object illustrated was originally vegetable and is now entirely mineral, for it is a petrified tree stump, located at Florissant, Colorado

THE TRUTH ABOUT THE CUCKOO

- - - - - - - by Edgar P. Chance

Scribner's, $4.00

THE European cuckoo has been a legendary bird whose call "cuck-oo," copied for cuckoo clocks, and whose habit of having its young brought up by strangers, were better known than the bird itself.

Thanks largely to Mr. Chance we now know that yearly the same female cuckoo, identifiable by the eggs she lays, returns to the same place and lays her eggs in the nest of some favorite host species, perhaps of that which was her foster parent. The sight of her prospective hosts starting nesting apparently furnishes a stimulus to her laying. When ready she glides down to the nest and with surprising rapidity lays her egg in it. The rest of the story is better known; the host cares for the young, and the young cuckoo ejects the rightful young.

How Mr. Chance found out all this is a story of boundless energy and perseverance. He knew his cuckoos personally, found all the nests of possible hosts, and conducted experiments on them. Finally he could predict when and where some of his cuckoos would lay their eggs and at his invitation many bird watchers witnessed this. He made a commercially successful motion picture, *The Cuckoo's Secret*, in 1921, and the next year published his book of the same title. The present volume is a revised edition, with additional material. Mr. Chance seems not to believe in evolution, but invokes natural selection to explain minor points. His section on mating is largely speculative and some of his suggestions, such as that cuckoos exert mesmeristic influence on their hosts, and that the host is "under orders" to care for the cuckoo's offspring, are not very attractive. However, this is minor, and his studies represent a great advance in our knowledge of the truth about the cuckoo.

A. L. RAND.

May

NATURAL HISTORY

1941

Pearl Divers • The Secretary Bird • Hopi Snake Dance

N. C. Nelson • Emeralds • The Japanese Beetle's Enemy

VOLUME XLVII, No. 5

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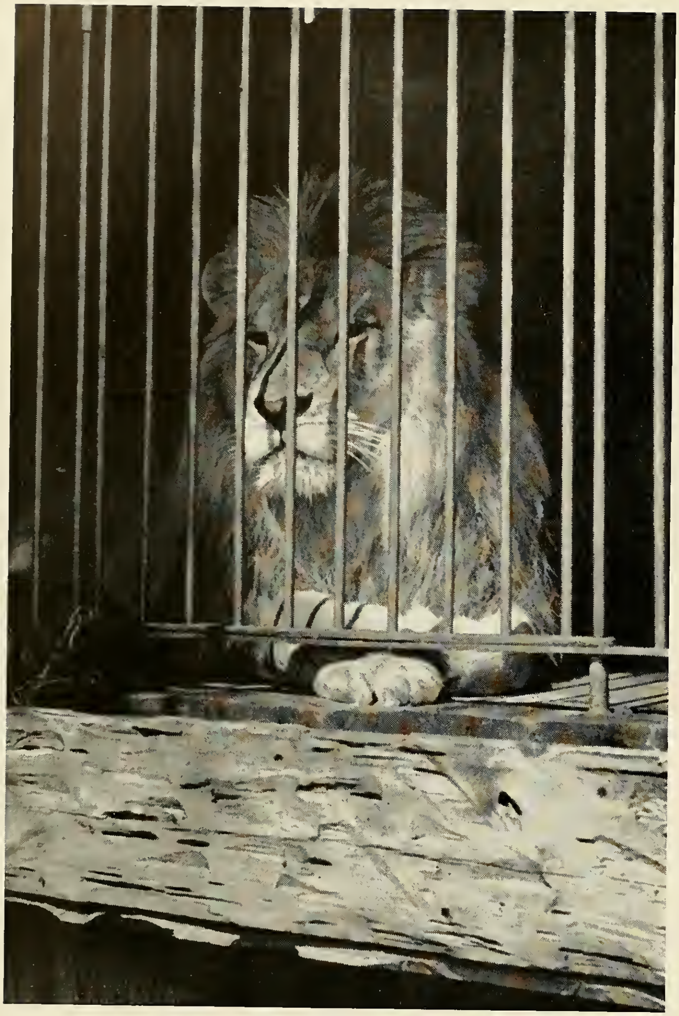

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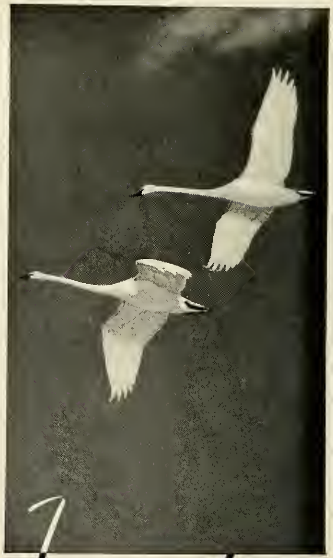

Natural History

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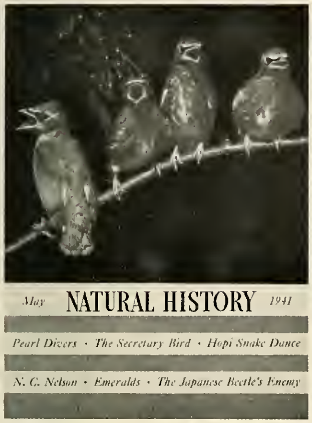
Above illustration painted by F. L. Jaques, from Bird Group of Hudson Bay Region in the American Museum of Natural History

LETTERS

THE COVER THIS MONTH

The young cedar waxwings on the cover of this issue, photographed in Kodachrome by Dr. Olin S. Pettingill, Jr., were nestlings about sixteen days old. At the time, the writer was working on a life history study of this bird at the University of Michigan Biological Station, and had removed these young from their bulky, cuplike nest for closer observation. They were able to undertake short flights at this age.


May
NATURAL HISTORY
1941
Pearl Divers · The Secretary Bird · Hopi Snake Dance
N. C. Nelson · Emeralds · The Japanese Beetle's Enemy

As they clung tightly to the branch, the young waxwings stretched their wide mouths upward, as though engaging in a mock feeding exercise, and flapped their wings eagerly, appearing ready for a take-off. Preening and stretching, the restless nestlings occasionally strengthened their bills by chewing against the branches and by pecking at each other.

When I handled them, the young all showed pugnacity toward me by striking my fingers with their bills and lisping belligerently behind their bold, black masks. They made gourmands of themselves as they feasted on the pin cherries. When they left the nest two days later they weighed several grams more than the adult waxwing, and when 20 days old were able to fly very well.

Robert B. Lea.

* * *

Sirs:

I have long admired your magazine Natural History and I am one of your cover-to-cover readers. . . .

Wilbur Forrest,
Assistant Editor.

New York Herald Tribune
New York, N. Y.

* * *

Sirs:

As a two-year reader of Natural History Magazine, I deeply appreciate your effort in spreading to many interesting and unheard of facts concerning nature and the world in which we live. Your excellent articles, as well as the splendid illustrations, make Natural History the world's outstanding magazine in its field, and I am very sure that all the ones who ever started reading it will never feel like giving it up. . . .

Charles Chessex, D. D. S.

Lausanne, Switzerland

* * *

Sirs:

Natural History is without doubt the finest magazine of its kind in the world. It is very highly praised by my school teachers and friends. The pictures in the Magazine are very good material for school use, as they cover practically every subject.

I especially liked in the January issue "Indian Sign Language" and "A Pet Walrus." Also in the February issue, "A Lynx in the Home."

I think you could improve your magazine by having more interesting back covers such as on the February issue.

Edwin Kessler.

Far Rockaway, N. Y.

* * *

Sirs:

I appreciate your magazine very much. I love science, and this magazine is the best I have ever read on that subject. I enjoy the rich covers and interesting articles and photographs. I find Natural History valuable when I wish to find out about certain subjects for a topic.

Barbara Fay.

Cambridge, Mass.

* * *

Sirs:

In the November number of your excellent magazine there was a series of unusually good photographs of the Philippines, with a short text by Fenno Jacobs. The character studies and the views of the Ifugao rice terraces were particularly fine. There is an error, however, in the description of the rice terraces. They do not serve as catch basins for rain water. The water supply comes from a series of springs near the crest of the ridge between Bontoc and Benaue. Elsewhere the rice paddies are either down in the streambeds or in positions where water may be led to them by means of simple ditches or bamboo pipes, not because of lack of skill in building terraces but because the planting season comes just before the rains. The paddies must be soaked thoroughly before cultivation, because all the work on the upper levels is done by hand. . . .

The article in the December number on the Angel Falls was very interesting. E. Thomas Gilliard might like to check up on a curious discovery I made a few days ago. I had picked up an old work *(Die Erde und ihr Organisches Leben,* Part II) in Manila, published apparently about 1880, and leafing ahead of the place where I was reading I found a quarter-page steel engraving on page 468 with the fol-

Continued on page 304

THRILLS
GALORE
IN
COLORADO
YELLOWSTONE
CALIFORNIA

Scenic wonders and pleasant experiences pass in gay succession in the romantic West—the Rocky Mountain region of Colorado with its snow-capped mountains, pine forests and rippling streams; the wild life and natural phenomena of Yellowstone; the ocean, redwood forests and movie colonies of California—these and countless other attractions make the West the mecca of summer vacationists.

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HABITAT GROUPS IN COLOR

By CHARLES H. COLES
Chief Photographer, American Museum of Natural History

THE remarkably realistic habitat groups in the American Museum of Natural History have caused many visitors to inquire how the animals were obtained without losing the pose they were in when captured. This, indeed, is high praise for the accuracy, artistry, and realism of these groups.

The striking compositions and accuracy of detail in the large habitat groups in the Akeley African Hall and in the Asiatic Hall have daily attracted large numbers of amateur photographers. A large percentage of their pictures are being made with color film, which makes us wonder just what results are being obtained. From our own experience it would seem that such pictures can only suggest the real beauty of the scenes—certainly not a true color rendition.

Color errors

One reason why the results can only approximate the actual colors we see in the habitat groups is because of the color balance the manufacturer has incorporated in the film. We would not, of course, use a film adjusted for daylight on these groups, because they are illuminated by incandescent lights. Furthermore, we should not use Kodachrome "A" because it is balanced for the bluish-white light of photoflood lamps.

Suppose that we were to make a picture of a group with type "A" film. Because the illumination in Akeley African Hall comes from ordinary incandescent lamps, which have very little blue in proportion to their yellow light, the picture would come out lacking in blues. The entire picture would look yellowish-brown, with the blue sky a sickly greenish tone. Naturally the effect is untruthful and not very pretty.

Since there is no other film to use for artificial light (except the larger size sheet films), some means will have to be used to correct the color of the light. In technical terms, we have to increase the color temperature of our light source. We in the Museum have made numerous experiments on the habitat groups and have found several ways in which to improve the color rendition of them.

Color correction

The first step is to use a faint bluish filter over the lens, thus correcting the yellowness of the lamps. The best filter for this purpose is called a W&W CC—6 Color Correction Filter. The use of this filter cuts your light down by about half, so you will have to give the scene twice as much exposure as you would without it.

The next step in making better color pictures is to confine your range to a small part of each group. In this way you won't have to struggle with irregular light intensities. The sky is usually from four to ten times brighter than the foreground of a group. This is too great a range for Kodachrome to cope with successfully, so either the foreground or the sky will suffer in color rendition. If only a small part of the sky is permitted to appear in each scene, the proper exposure for the foreground may be given and the sky allowed to overexpose.

Take pictures of animals that are near the background of the group. These animals receive better illumination on the front and under sides of bodies than those in front.

Exposure problems

If you insist on photographing the whole group at once, reconcile yourself to the trial-and-error method for determining exposure. So far we have found no simple relation between exposure meter readings and the exposure that we have found to give the best results. For some of the groups the geometrical mean intensity of the highlights and shadow readings may form the basis of exposure calculations; but if your meter or your mathematics is not up to that, you'll have to "cut and try."

If you're conservative enough to take only a portion of the group, take your meter reading on that part of the group to be photographed. On very dark groups representing forest interiors, give twice as much exposure as the meter indicates. Kodachrome is not very sensitive to green.

For the greatest realism, use a fairly large lens opening so that the background is permitted to go slightly out of focus. Then you'll really fool your friends when they see your pictures of wild animals of darkest Africa.

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THE FREE MIND

TODAY, as never before in modern times, we see the biological principle of "survival of the fittest" distorted into an excuse for mass brutality in total disregard of all the spiritual aspirations built up since the prototypes of modern man appeared in the Glacial Period. "Superior race" is the creed on which Hitlerism thrives. The aim of emergence of species, including man, through ruthless competition is glorified, although co-operation in nature has been demonstrated throughout the ages. Thus we have seen in a dictated Europe the regimentation of the schools, the elimination by death or ostracism of all intellectually honest teachers and leaders, the closing of colleges and universities, the burning of books, and the destruction of museums.

The struggle of the democracies against the dictatorships is not only a fight for freedom to live, a fight to satisfy physical and emotional hunger, but it is just as importantly at present, and even more importantly for the future, a fight for the freedom to think.

In this struggle the museum stands at the forefront of the institutions designed to satisfy intellectual hunger. The museum is not limited like the public school to the young. The museum is not dedicated like the college or university solely to the educated. The museum does not, like the library, serve only the literate. The museum deals with all peoples on all levels and can and does reach out to meet the intellectual hunger of all people of every degree on all levels of intellectual attainment. It is a democracy's most important agency for the spread of honest understanding of life.

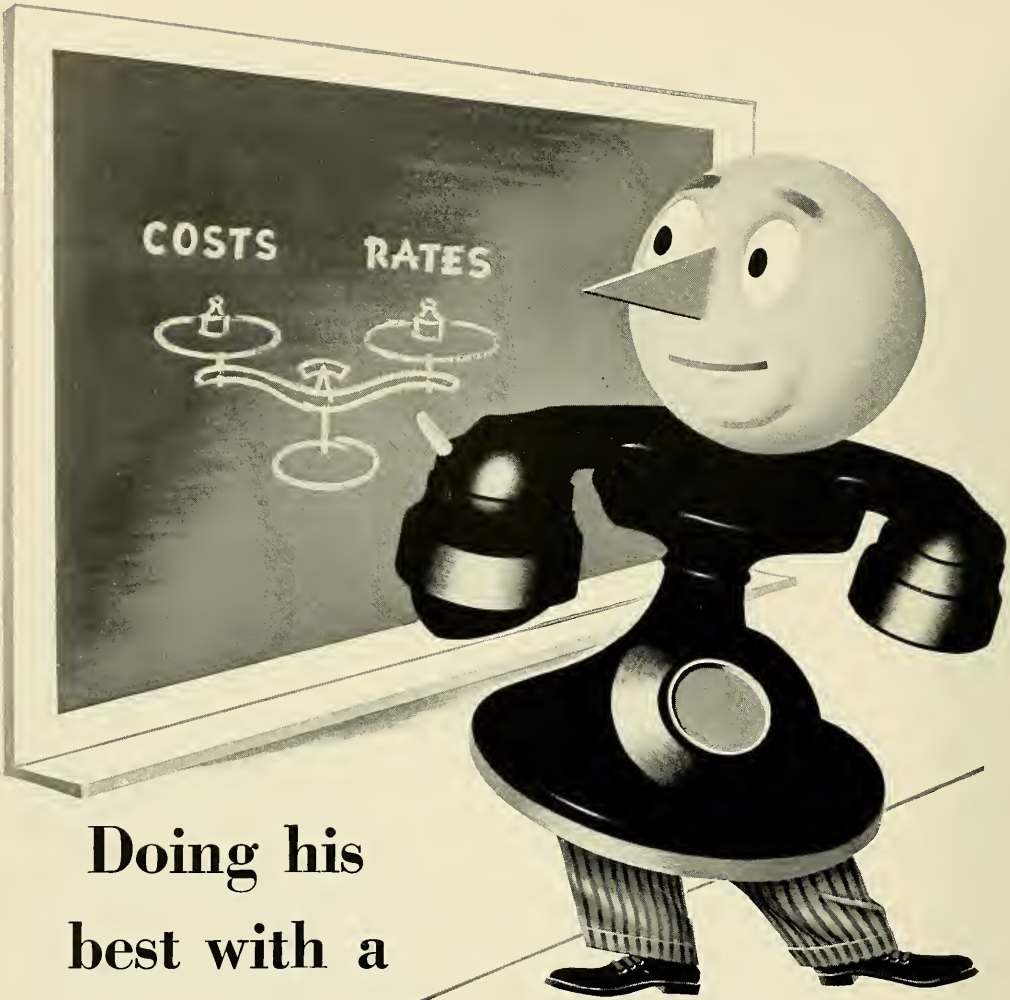
During a period when measures of defense of freedom and democracy take shape in the training of men and the production of materials, we must not let the fact be forgotten that in the end the surest defense for democracy is an enlightened people. To this end all possible springs of knowledge must be enlarged and the channels of information deepened so that understanding may flow unimpeded to all people who hunger for it.

A distinguished geographer said, "Man alone of all creatures is able to worry about the future and to make provision for meeting problems for which he did not inherit a solution." In other words, man has the unique privilege of being able to think out his own salvation. The real work of the museum is to help people to think in terms of realities and not theories.

The Museum is the one center in which the mighty record of life is preserved. To obtain this record and to house the specimens adequately against the time when many of the species will have vanished from the earth has been, and is, a motivating force of the institution.

But just as important is it to use these vast collections effectively not only for the benefit of pure science but for objective teaching in its exhibition halls. Our chief concern is to meet the needs of a changing and chaotic world in what we teach and how to teach it.

FROM THE ANNUAL REPORT OF THE PRESIDENT,
THE AMERICAN MUSEUM OF NATURAL HISTORY



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NATURAL HISTORY

The Magazine of the American Museum of Natural History

Frederick Trubee Davison, President — Roy Chapman Andrews, Sc.D., Director

VOLUME XLVII—No. 5 ★ ★ ★ ★ ★ ★ ★ **MAY, 1941**

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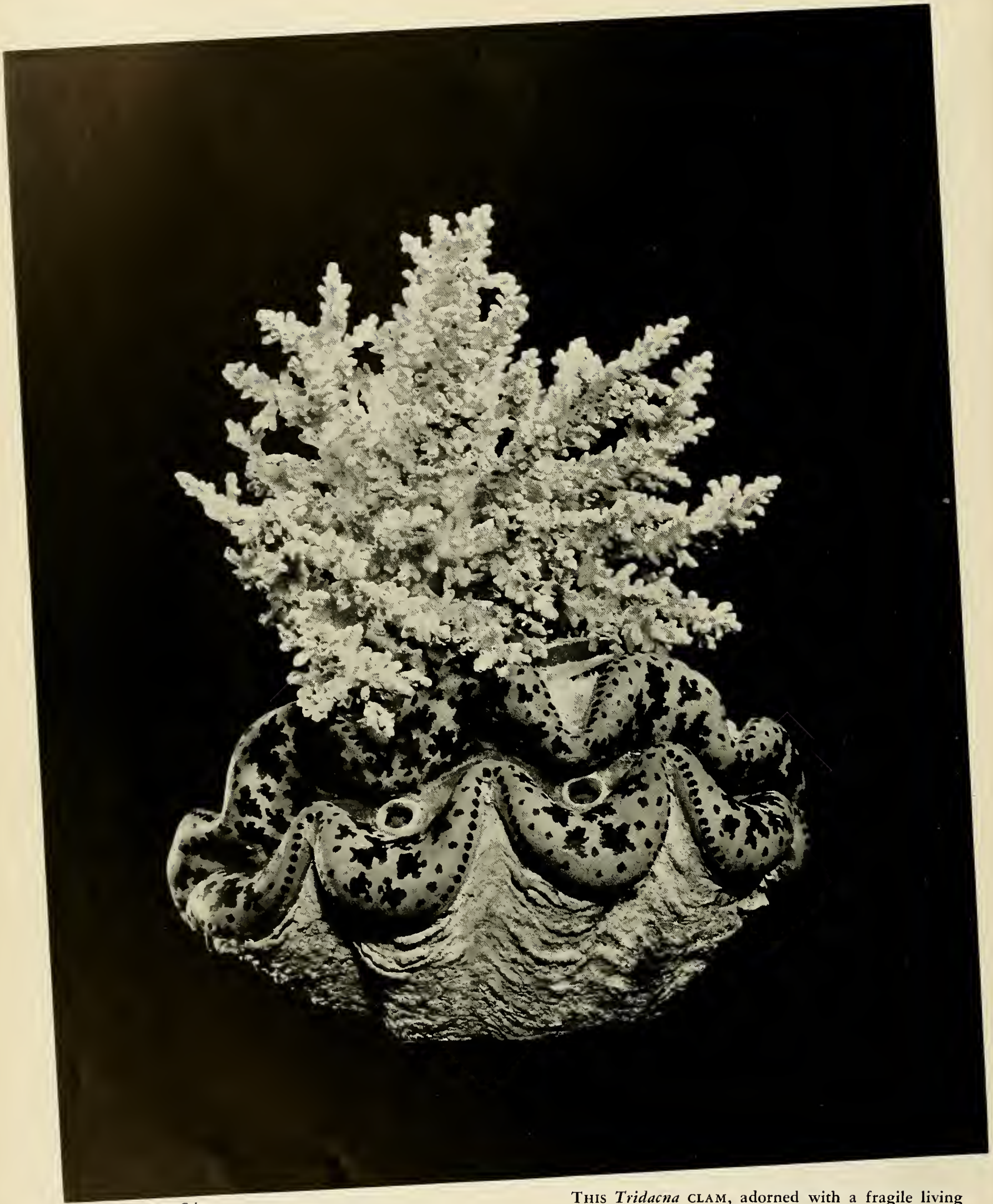


AMNH photo by Coles

THIS *Tridacna* CLAM, adorned with a fragile living coral, grew on the lagoon floor, 25 feet below the surface. The photograph represents the animal modeled in wax within the actual shells so as to display its gorgeously colored mantle edges, which, in life, expand over the scalloped shell margins

PEARL DIVERS

By Roy Waldo Miner

Curator of Living Invertebrates, The American Museum of Natural History

An account of an American Museum expedition to the South Pacific to obtain material and data for a new group in the Hall of Ocean Life depicting the undersea activities of the Polynesian natives in their traditional search for the treasures of the deep

The *Zaca* was lying at anchor off Penrhyn Island, called Tongareva by its native inhabitants. A stiff breeze, blowing over the land from the east, raised dancing multitudes of whitecaps, their snowy crests contrasting strongly with the deep ultramarine of the tropic sea. The white strand of the distant shore, disappearing and appearing alternately as the foaming breakers dashed against it, was crowned with long lines of coconut palms tossing their green plumage as the trade wind swept over them. Midway, their verdant line was broken by two shelving points, bare and rock-strewn, that seemed nearly to meet on either side of the narrow West Pass, the only practicable entrance for our vessel to the sheltered lagoon of the coral atoll.

As we watched, a sail appeared in the opening, delicately threading the tortuous channel, and headed for the open sea. It was followed by another and another, and finally a multitude of craft, obviously smaller than the leading vessel, emerged from the opening and shaped their course directly toward us before the wind.

Examining them through our glasses, we saw that the larger boat was a sloop, flying the blue of the British colonial ensign, and realized that we were to receive an official call from the Government Agent in charge of the island. As the fleet drew nearer, we made out that the smaller vessels were numerous outrigger canoes, their single sails manipulated skillfully by their Polynesian navigators. Soon they arrived alongside, and, as the Agent, Philip Woonton, came aboard, the owner of the *Zaca* and sponsor of our expedition, Mr. Templeton Crocker, met him at the gangway and escorted him aft to meet us. Almost immediately, the dusky-skinned natives swarmed over the gunwales, examining the vessel and fraternizing with the sailors forward.

Philip Woonton, clad simply in jersey and white trousers, with a native broad-brimmed straw hat shading his swarthy face, greeted us hospitably. Mr.

Frank Tiaga, Samoan sailor from the *Zaca,* equipped with water-tight goggles, diving for corals. Through his efforts many of our finest specimens were secured, including the great 900-pound coral shown on page 261

Photo by Wyllys R. Betts

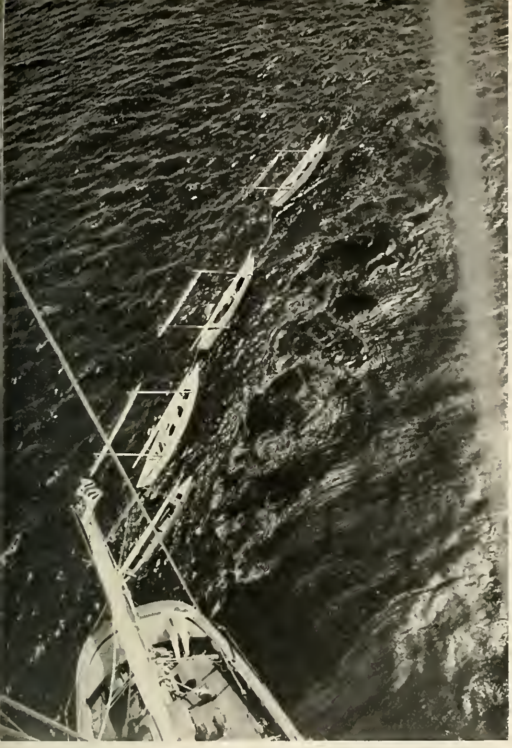
(Left) THE GRACEFUL POWER-SCHOONER, *Zaca,* which carried our expedition to the South Seas, riding at anchor outside the atoll of Tongareva, while waiting for a native pilot

(Right) THE *Spray,* official boat of the British Government Agent, Philip Woonton, emerges from the Tongareva lagoon to welcome the expedition to the island

Photos by Roy Waldo Miner

(Below) THE *Zaca* under way toward the West Pass, the difficult lagoon entrance, guided by a skillful native pilot. Mr. Crocker, Mr. Woonton (in broad-brimmed hat), and other members of the Museum party are standing near the after rail

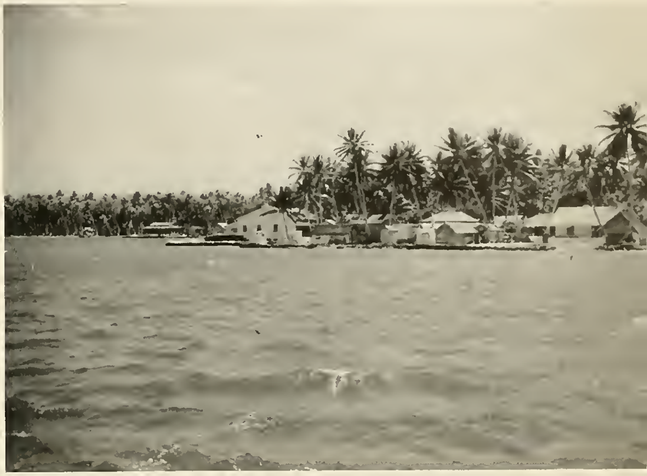
Photo by Toshio Asaeda



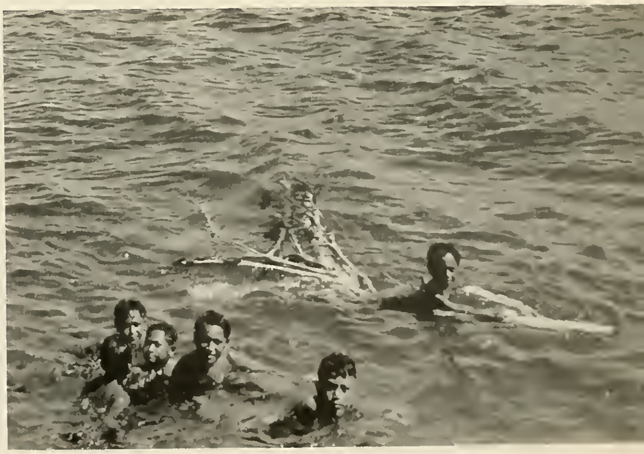
(Left) Native outrigger canoes being towed astern as seen from the masthead. Their native crews are aboard the *Zaca* curiously examining the vessel and fraternizing with the sailors forward

(Below) The native village of Omoka nestles beneath groves of coconut trees on a point of land inside the circle of the lagoon. The *Zaca* came to anchor beyond this point

Photos by Toshio Asaeda



(Below) Native boys, supported by half submerged branches of trees, swam around the *Zaca* for hours, curiously watching our movements

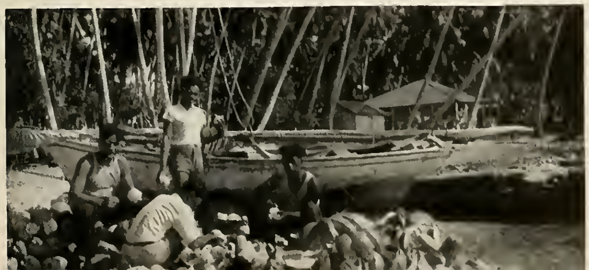


(Left) The narrow native canoes are made from scooped-out tree trunks with plank gunwales fastened on by twisted cords of coconut fiber. Outriggers keep them from capsizing when under sail

Photos by Roy Waldo Miner

(Below) Tongarevans cleaving coconuts on sharpened stakes. The coconut meat is dried to make copra and sold to passing trading schooners. It is eventually used for making confectionery and soap

(Below) The dense groves of coconuts furnish the natives with all the necessities of life, including food, drink, clothes, and housing



Crocker handed him our credentials, including a letter of introduction from our friend, Dr. Peter Buck, the Director of the Bishop Museum of Honolulu, who had previously spent much time on the island studying its inhabitants, and had established most cordial friendship with him. This settled the matter and we were informed that the entire island and its inhabitants were at our disposal.

When Mr. Woonton learned that the purpose of the expedition was to make a study of the pearl oysters, which, Dr. Buck had said, abounded in the lagoon, with the view to building a group in the American Museum representing the native divers in the act of gathering them, he became quite enthusiastic and assured us of every assistance in his power.

His most experienced native pilot was then called aft to the wheel, and soon our engines were driving the *Zaca* against the wind toward the narrow entrance, towing behind us Mr. Woonton's boat, as well as a long line of the native dugouts, attached tandem fashion to our stern.

A narrow opening

Very shortly, we were tossing in the midst of a swirl of conflicting currents and foaming whitecaps, as we negotiated the narrow and perilous entrance channel, and then, suddenly, we were quietly riding in the calm turquoise waters of the lagoon. Under the guidance of our pilot, we skirted the luxuriantly green inner shore, rounded a point of land, and soon were floating at the anchorage assigned to us. Opposite lay the picturesque little native village of Omoka, with its simple dwellings nestling under dense groves of coconuts that seemed to crowd every inch of available space. As soon as we had rounded the point, all the inhabitants, men, women, and children, came crowding down to the shore and even invaded the water, paddling around us in their canoes or bobbing about the boat as they swam as near as they dared—for Woonton had warned them to keep at a respectful distance.

Tongareva is a typical atoll, or ring-shaped island of coral, surrounding a central lagoon, one of many such beautiful formations in the South Pacific Ocean. It forms a large oval, eleven miles through its greatest diameter, composed of a series of long, narrow islets, called *motus,* connected by stretches of coral reef, awash at low tide, and absolutely impassable for boats. The waves of the open sea dash against the outside of these reefs with considerable violence, rushing through into the lagoon at high water.

Coral atolls are usually most accessible on their western side, many of them having but this one entrance. Some, however, are completely landlocked, with lagoons that can be navigated only by small boats or canoes carried across the barrier by hand.

All the *motus* of Tongareva are covered with dense growths of tropical vegetation, mostly coconuts. The plantations are almost over-dense, for the natives refuse to thin them out, believing that the value of their land depends on the number of coconuts growing on it. These remarkable trees do not have to be cultivated, as they spring up without any trouble on the part of the inhabitants. They furnish the natives with the material for houses, clothing, mats, cordage, fish nets, food and drink, so they cannot be blamed for considering them as the foundation of their well-being. In fact, the coconuts have also brought the Pacific Islanders a measure of prosperity. For they dry the meat of the nuts to make copra. This is exported in large quantities for the manufacture of soap. The lagoon abounds in tropical fish of all kinds, which form additional food resources, as the islanders are expert fishermen. Finally, Tongareva, like many other Pacific islands, produces the precious pearl oyster, the iridescent shell of which secretes mother-of-pearl and is sold by the ton to trading schooners, to be used for knife-handles, inlays, and pearl buttons. Occasionally, a shell is found which yields a precious pearl, often of great value, enriching the finder, the middleman, and the merchant. As we have said, it was to study these pearl oysters in their native environment that we came to Tongareva.

We found the Tongarevans intelligent and cooperative. They are of the Polynesian race, said, with good scientific authority, to show certain Caucasian traits, doubtless having spread hundreds of years ago into the Pacific Islands from southeastern Asia. There were between 450 and 500 native inhabitants on the island at the time of our visit, mostly living in two villages at opposite ends of the lagoon, known as Omoka and Tetautua, respectively.

Exploring the bottom

Mr. Woonton assigned two natives to us,—Tau, who was the "policeman" of the village, and Toni, a young boy. Both were excellent swimmers and divers, and Tau, particularly, knew all the reefs and shoals intimately.

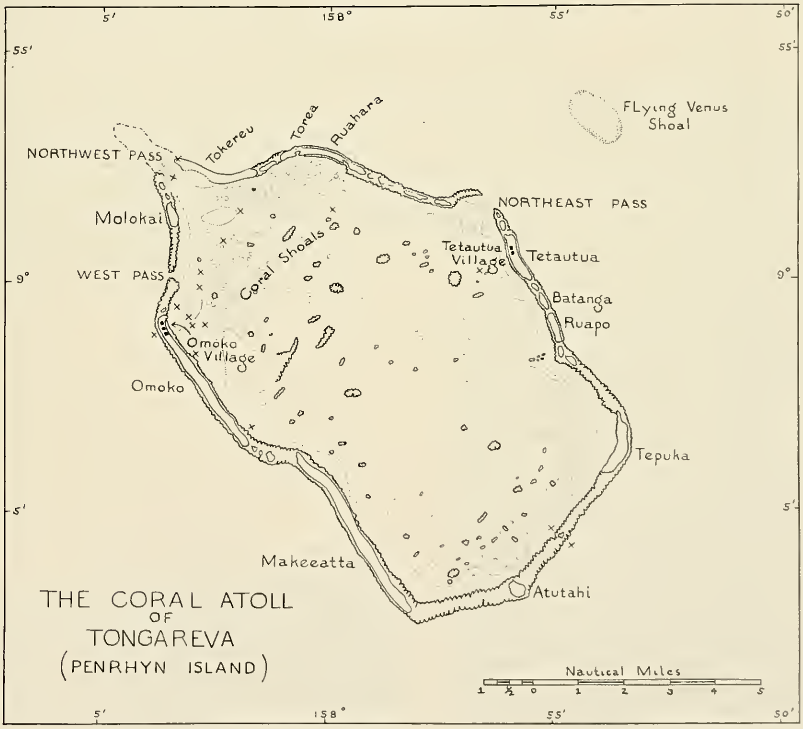
Under his guidance we spent the first two or three days exploring the region in one of the *Zaca's* launches, especially around the coral shoals in the western part of the enclosed lagoon. The waters were very clear, and, using waterglasses (buckets with a glass bottom), we could see the sea floor very clearly for 60 feet or more, and thus were able to pick out the best localities for our undersea investigations. On the third day after our arrival, we were all ready and had our equipment put in order for the work. We then started in earnest and, as we had good weather, we kept on for nine days without a break.

Our method was as follows. Two boats belonging to the *Zaca* were put at our disposal. One of these, an "otter boat," was a small and handy motor launch; the other was a dory. The otter boat carried our photographic equipment,—cameras, undersea camera boxes, and photographic films—, in charge of René, the radioman. Also, Toshio Asaeda, the Japanese artist and photographer of the *Zaca,* was installed here with his sketch blocks and colors, with John, the first mate, as navigator. The dory was reserved for the diving equipment. In it were the two diving helmets with their pumps and hose; the special undersea camera tripods and the hand nets; also, the "bang-bang" (to be explained later), the waterglasses, and the brass-rope ladder. Betts, Olsen, and I occupied this boat with the two sailors who were to man the pumps.

We arrived at our location alongside one of the many shoals. These are interesting growths of living coral composed of many species which, by their combined activity, had grown up from the lagoon bottom, at first as clustered pinnacles, then as broadening columns, which spread out their flat, mesa-like tops within a foot or two of the water surface. The top and sides of these castle-like limestone structures are made up of fragile branching colonies and massive domes of living coral of soft contrasting colors.

The anchors of the dory were thrown out across the top of one of these shoals, thus securing it fore and aft. The otter boat was then lashed parallel to the dory on its outer side. The brass-rope ladder, with rungs one foot apart, was unrolled over the gunwale, to which it was fastened at the top, the lower end trailing over the sea floor 20 or 25 feet below. I was always the first to go down. I stood on the ladder, submerged to my shoulders, while the diving helmet was lowered over my head. The pump was started, and when I felt the stream of fresh air entering the helmet and the comforting clank of the pump beat near my ear, I descended the ladder. Immediately, the 65-pound helmet completely lost its weight as it submerged, and I myself seemed as light as a feather. I climbed down, rung after rung, swallowing as I went to relieve the increasing pressure against the eardrums, and stepped off on the sandy sea floor from the twenty-fifth rung, thus measuring my depth from the surface as 25 feet.

I turned from the ladder and saw before me the precipitous side of the shoal, rising above me in terraces, with overhanging growths of fantastic shapes, adorned with the most beautiful corals imaginable in rich purples, blue, browns, saffron orange and green. Their shapes varied from huge rounded domes to the most delicate lacework, interspersed with contorted fingerlike lobes, gathered in clusters of rich rose. Round about me and above my head flitted fishes of the most gorgeous and weird combinations of color and form, many of them reflecting the sunlight like jewels of coruscating brilliancy and changing prismatic hues. The immediate neighborhood was as transparent as air. I could see fully 100 feet in all directions before the gathering luminous blue fog of the watery distance limited my vision. The undersurface of the water above me gleamed with silver, reflecting like a mirror when quiet, and changing into dancing quicksilver when a breeze threw the surface into ripples and waves.



THIS TYPICAL ATOLL, 2000 miles directly south of Hawaii, is made up of islets connected by half submerged coral reefs, surrounding an eleven-mile lagoon. The crosses mark the coral shoals where the Museum's undersea studies were made

Photo by Roy Waldo Miner

The brawny arms and magnificent chest muscles of Frank, the Samoan sailor, were always at our disposal for sculling our boats and diving for coral specimens, many of which were huge masses dislodged only with great difficulty

Photo by Wyllys R. Betts

Frank's favorite tool was the conventional carpenter's ripping bar, which he used for prying corals from the reef. He is seen above appearing like Neptune from the depths, having climbed to the top of a coral shoal after a 25-foot dive down its precipitous side

(Right) Diving near a coral shoal to which the boats have been anchored. Doctor Miner is standing on the brass-rope ladder waiting for the diving helmet to be placed over his shoulders. Two sailors stand ready at the air pumps. Wyllys Betts (with goggles) swims near by. The boat contains waterglasses, undersea tripods, and other diving equipment

Photo by Toshio Asaeda

Photo by Roy Waldo Miner

(Left) Doctor Miner goes down. The diving helmet has been placed over his head, the pump started, and the air, entering the helmet through the hose, keeps the level of the water below the diver's chin. Though the helmet weighs 65 pounds in the open air, it immediately loses weight when submerged. The ladder rungs are set one foot apart. The diver counts them as he descends so as to know the depth at which he steps off the ladder

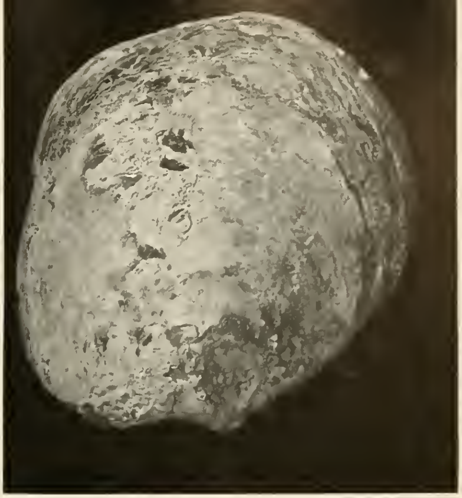
Doctor Miner at the bottom of the sea. The submarine tripod and the rope ladder are visible beyond him. He is examining a cluster of precious pearl shell

Photo by Chris Olsen

(Right) Tau has just descended with the submarine camera. After placing it on the tripod, he swims to his favorite pinnacle to watch the photographic operations

Photo by Toshio Asoeda

(Above) TWO DIVERS ARE DOWN, as shown by the double line of hose, the patches of bubbles, and the shadowy diving helmets visible through the disturbed but clear water



AMNH photos by Coles

TYPICAL PACIFIC PEARL SHELL. The outside *(above)* is rough and shows encrustations and growth lines. The interior *(below)* is lined with iridescent nacre or mother-of-pearl

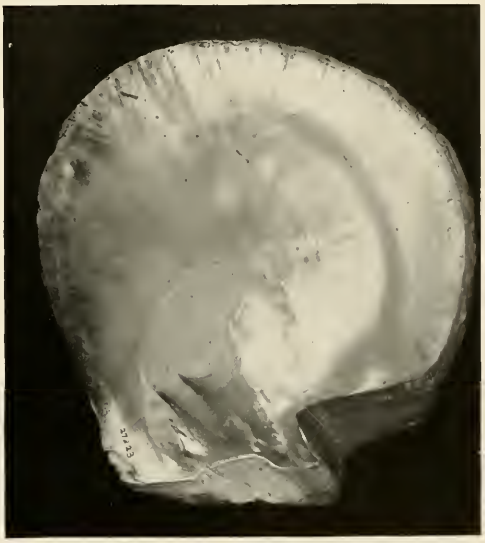


Photo by Roy Waldo Miner

TAU, the Tongarevan diver, has discovered a large cluster of pearl shell and calls the submarine photographer's attention to his find, as he severs the tough byssus threads by which they are attached to the sea bottom. The amphibious Tau stays at the bottom three or four minutes at a time. He rises to the surface at intervals to renew his air supply, returning immediately to his search for the pearl shells which grow abundantly in the lagoon

(Below) CHRIS OLSEN painting undersea. An oiled canvas stretched over plate glass is framed in a metal easel. Oil colors are pressed on with a palette knife

Photos by Roy Waldo Miner

Photo by Roy Waldo Miner

Courtesy of Marcus & Company

A PRECIOUS Oriental pearl

I took a step forward, half floating. A push of my foot sent me in a gentle, slow-motion stride over a pinnacle as high as my waist, and I settled down on the other side, my toes balancing on a great purple dome as lightly as thistledown.

Undersea photography

The silvery water surface above my head broke, and the legs and square top of my tripod appeared, pushing through with a cloud of bubbles as it hung grotesquely from a hook at the end of a cord. It was lowered with a series of irregular jerks to the sea bottom a few feet away. I made my way over to it deliberately with half-floating steps, allowing the pressing watery medium to support me as I did so, instead of wasting strength in trying to push it aside. When I reached for the tripod, my hand closed on nothing, for the magnifying quality of the water deceived my eyes in estimating distance. I groped toward it, in full vision, and watched my hand finally close about it like the hand of another person. Slowly I placed the tripod in position; and then I saw, hanging near by, one of the loaded camera boxes with motion-picture camera enclosed. I placed it on the tripod, took note of the distance for which it had been focused chalked upon its side, and signaled with my arm toward the lower end of a waterglass through which John was gazing weirdly down at me from above.

The surface water broke again, and a coil of line, weighted with lead sinkers, floated down to me. I fastened one end of this to the coral growth toward which the camera was pointing and measured the distance to my lens, counting the sinkers which had been attached at measured intervals for that purpose. I adjusted the tripod and camera, pressed the lever that connects with the shutter within, and ran off the film for a motion picture of the submarine vista with the strange and beautiful fishes that came flitting, like actors, across the coral stage. I repeated this in various directions until the film was completely exposed. I looked up to signal again and saw the legs of Tau, the diver, hanging near the boat. I raised my hand, and immediately he let go and sank down near me with another loaded camera box. He set it on my tripod, in place of the first, which I was now holding in my hand. Then he relieved me of my burden, and, with a push of his foot against the sea floor, swam vigorously to the surface, heavy box and all, to deliver it to the waiting hands of John. In a few minutes, Tau was down again and swam over to a neighboring pinnacle to which he clung, so as to watch me at his leisure. He rose to the surface occasionally when he needed air, but he always returned to the same spot to wait until my camera ran down, when he swam over to get it and take it again to the surface. He seemed like a veritable amphibian!

Now, down the ladder, came another pair of legs. It was Olsen, equipped with the other helmet. In his hand he had a nonrustable metal palette, with oil colors arranged around its margin in the conventional manner. When he reached the sea bottom, he waited until an easel of the same metal was lowered, framing a sheet of plate glass with oiled canvas stretched over it. He then carried this outfit a short distance away, set up his easel on a rock, and, standing before it, looking like a hobgoblin in his diving helmet, proceeded to lay oil colors on the oiled canvas, pressing them down with his palette knife, thus painting undersea the color and arrangement of the coral formations!

I turned my camera toward him and made a motion-picture record of this unusual performance.

Octopus

On the sea floor, a short distance away, I now espied a fine cluster of living pearl oysters. I went over and examined them carefully. Returning to the camera, I made a careful photograph of them and of several other clusters which I discovered nearby. I signaled again, and Tau came swimming down. I pointed out the pearl oysters, and he swam over, separated them from the coral rock to which they were fastened by means of their tough byssus, and bore them to the surface in his arms. Meanwhile, all this was recorded by the camera. Olsen had now gone above, and Betts took his place. He came over and touched my arm to draw my attention to the side of the cliff, where an irregular cavern opened above a threshold of coral. A tapering serpent-like tentacle was sliding out over the rounded surface, followed by another and another, all armed with disk-shaped suckers! Immediately behind them a bulb-shaped head erected itself above a pair of baleful eyes, regarding me with basilisk-like stare. I turned to my camera, but the film had run out. I signaled for another, and it was quickly lowered to me. I made the exchange as rapidly as possible, meanwhile keeping an eye on the octopus. While I was thus engaged, the creature slid forward over the coral head, bringing all eight of its tentacles into view. Suddenly it launched forward into the water, bulb-shaped head foremost and tentacles streamlining out behind, and swam over to another ledge a little farther away. Meanwhile, I was struggling to adjust the new camera, but when I had it in position, to my disgust, the creature slipped around the shoulder of the cliff and vanished. Another opportunity lost! However, we later captured several others and were able to study them at close range in the aquarium on the deck of the *Zaca*.

Now for the "bang-bang"!

Many of the gorgeous butterfly fishes, goatfishes, filefishes, and scarlet-spotted tangs eluded all the usual methods of capture, so I had to fall back on this unusual apparatus. It consisted merely of a bamboo pole about ten feet long, carefully weighted and balanced with sheet-lead, and having at its end a couple of dynamite caps. Attached to these, a long insulated and waterproofed electric cord was looped along the pole, passing through my hands, and extending 30 feet upward to the boat, where John sat with a switch box between his knees. I would walk along the sea bottom in my helmet, holding the pole out in front of me, stalking the fish I wanted. When I managed to get the caps about a foot above the head of a gaily colored butterflyfish, I would jerk the cord, as a signal to John, who would then close the switch. There would be an explosion, and the fish would flop over, stunned but not killed. Meanwhile, Tau would be swimming at the surface, with a hand net, watching me through the goggles that he always wore undersea. As soon as he heard the explosion, he would swim down, capture the fish in his net, swim to the surface, and turn it over to Toshio, who was waiting in the launch. The Japanese artist would quickly put the fish into a pail of sea water, where it would soon recover. Meanwhile, he would make an accurate record of its color pattern, while still in its fresh condition, before captivity had caused it to fade, as is often the case. This process was repeated again and again. When we returned to the *Zaca*, Toshio would make finished paintings, utilizing his sketches as data, while Olsen and Betts would make plaster molds of the fish. Later, when we reached the Museum, we made wax casts of the fish from the molds, which could then be colored from Toshio's paintings to make life-like replicas of the fish.

That all can see the diver's world

For nine successive days we made trips of this kind to all parts of the lagoon, according to the plan we had evolved when we arrived. We dove morning and afternoon, staying down in the warm transparent waters as long as we wished. I made more than 70 dives during that period, and Olsen and Betts kept the other helmet just as busy. We took thousands of feet of undersea film, made hundreds of sketches of the living fishes and corals in color, secured scores of pearl shells, ten tons of beautiful corals, and specimens of many other invertebrates, as well as notes of many original observations. While we were working, we saw plenty of sharks, morays, octopuses, and poisonous starfishes, and had some interesting experiences with them, but, fortunately, nothing of a serious nature occurred.

Our largest and finest coral is a beautiful spiral growth weighing 900 pounds and measuring five feet in diameter. This is now a conspicuous feature in the Pearl Divers Group in the Hall of Ocean Life of our Museum. We also photographed the native divers while they were collecting pearl shell and made careful photographic studies of them ashore, from which life-size models were afterward constructed for the group.

A submarine fairyland

The Pearl Divers Group, which has been built as the result of this expedition, will be completed in a few weeks. It has involved much precise and unusual technique to produce it on the part of the artists and modelers of our Department of Living Invertebrates. It represents two Tongarevan pearl divers plunging down into a coral gorge, faithfully reproduced from one of the magnificent formations that we actually visited on the sea floor of Tongareva. In the midst of this submarine fairyland, they are engaged in plucking precious pearl shell clusters from the ocean bed, daring the menacing octopus sliding out from the entrance of a mysterious sea cave. The divers swim and grope past beautiful and grotesque coral growths to find their prizes among sea gardens of stone flowers, glowing in all the soft colors of the spectrum, while fishes of every gaudy hue dart past them. Beneath the great spiral acropore coral in the center lurks a scarlet, sixteen-pointed sea star with hundreds of poisonous spines menacing from its upper surface.

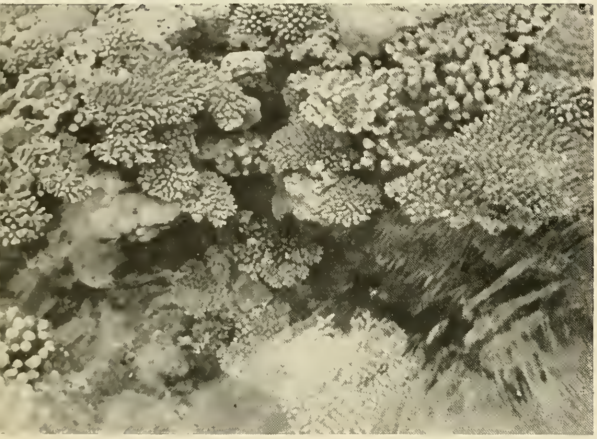
Among the corals on the bank toward the left, may be seen a bed of furbelowed *Tridacna* clams with sinuous openings, festooned with gaily colored mantle-edges. These are the man-trap clams, to be avoided by the hands or feet of the swimmers, lest the unwary diver be caught and held between the vise-like valves.

Over on the right, the visitor is given an opportunity to peer through a special opening into the Cave of the Octopuses, to spy upon the grisly inhabitants at home, while a vista into the distant water-world is glimpsed through a submarine tunnel.

The group, as a whole, reproduces a characteristic association of sea creatures typical of the coral reefs of the tropical Pacific and illustrates one of the more primitive methods of fishing for precious pearls.

(Left) Upper surface of a shoal of living coral photographed through two feet of water. The anchor rope of the work boat is visible across the shoal at the left of the picture

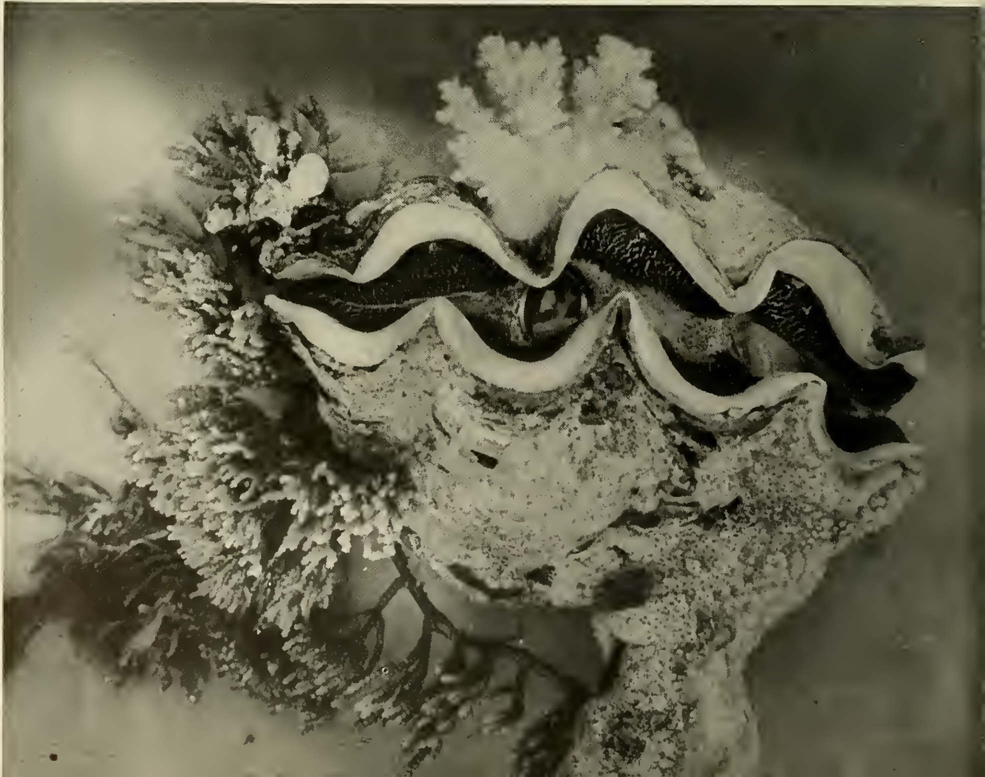
Photos by Wyllys R. Betts

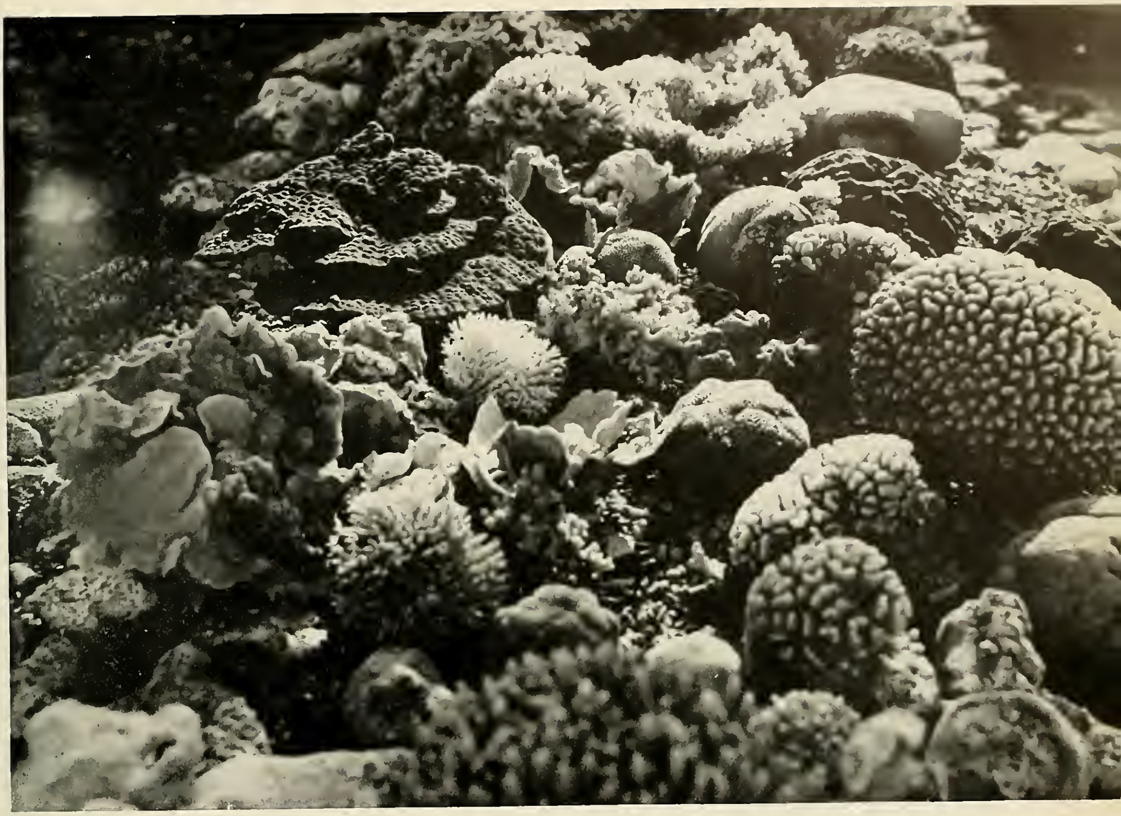


(Left) Edge of above shoal with closer view of the coral growths. The water is so transparent that clusters are visible even at a considerable depth

(Below) A living *Tridacna,* the furbelowed or man-trap clam. Between the slightly open valves of the shell may be seen the thin membrane of the mantle cavity pierced by two mantle openings. The oval margin of the left-hand aperture is visible, showing the mottled lining of the mantle cavity within. The thick edges of the mantle, adorned with multitudes of thin, brilliantly blue stripes, are expanding over the scalloped edges of the shell

Photo by Toshio Asaeda

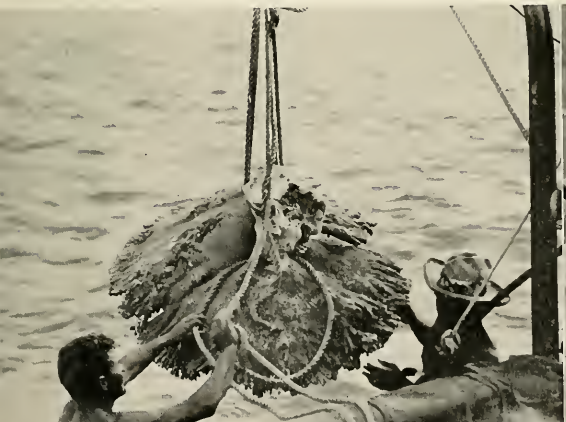




(Above) PART of the coral collection of the expedition, assembled on the dock at Tongareva after having the outer animal tissue removed

(Below) THE largest coral collected, weighing 900 pounds. Secured with difficulty by Frank Tiaga and two Tongarevans, it is shown here being hauled aboard the *Zaca* after being brought from across the lagoon. The entire coral mass is five feet in diameter and now forms an important feature of the Pearl Divers Group in the Museum

Photos by Toshio Asaeda



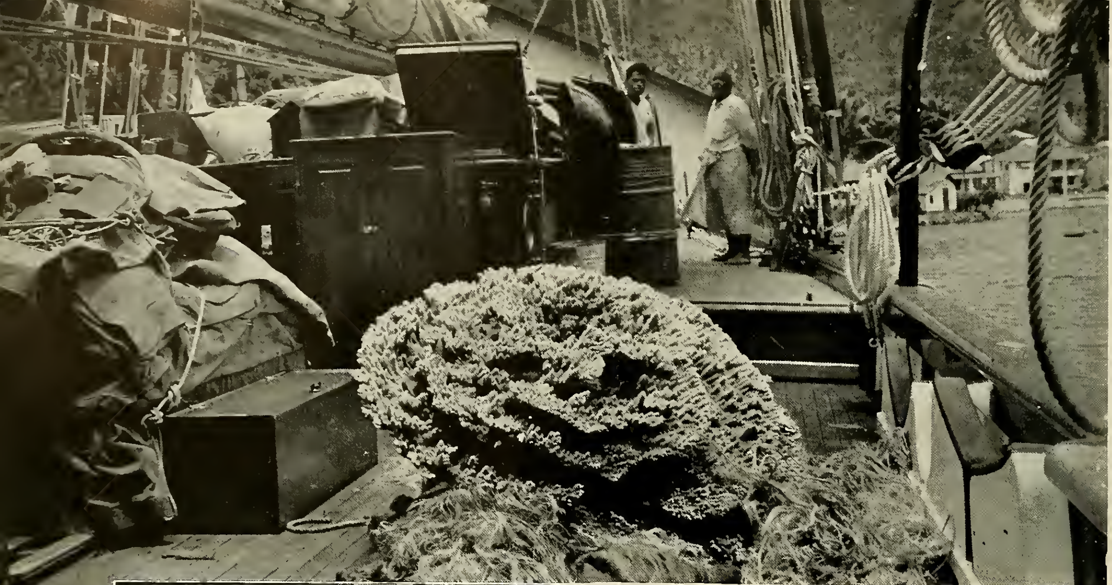


Photo by Roy Waldo Miner

(Above) THE GREAT acropore coral specimen aboard the *Zaca*. Its unusually symmetrical form and the spiral character of its growth are well displayed in this picture. This coral, together with the rest of the collection, was brought to Pago Pago, Samoa, on the *Zaca*. Two Samoan natives are seen in the distance

(Left) THE LARGE CORAL being permanently packed for shipment to the Museum. Its bottom was carefully secured and the specimen braced against the sides of the box, while they were being built around it

(Below) FRESHLY collected corals were brought aboard the *Zaca* at Tongareva, placed in tubs of sea water and thoroughly washed by hosing to remove the animal tissue covering the outer surface. This is known as "bleaching"

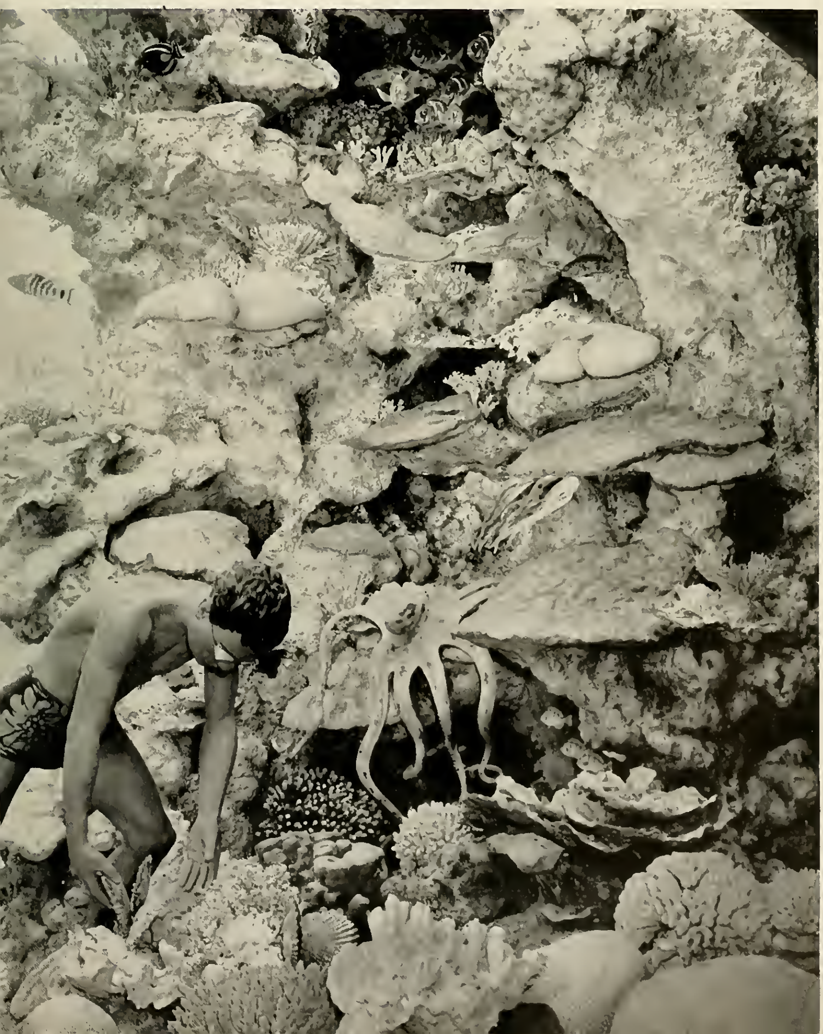
Photo by Toshio Asaeda

Photo by Wyllys R. Betts

(Right) THE COMPLETE COLLECTION on dock at Pago Pago, still roughly packed as it left the *Zaca*. The skilled sailors at the Naval Station carefully crated the entire ten tons of material for shipment to the United States. The collection included corals and hundreds of pearl and *Tridacna* shells. In the foreground may be seen plaster molds made directly from the fishes collected for the group

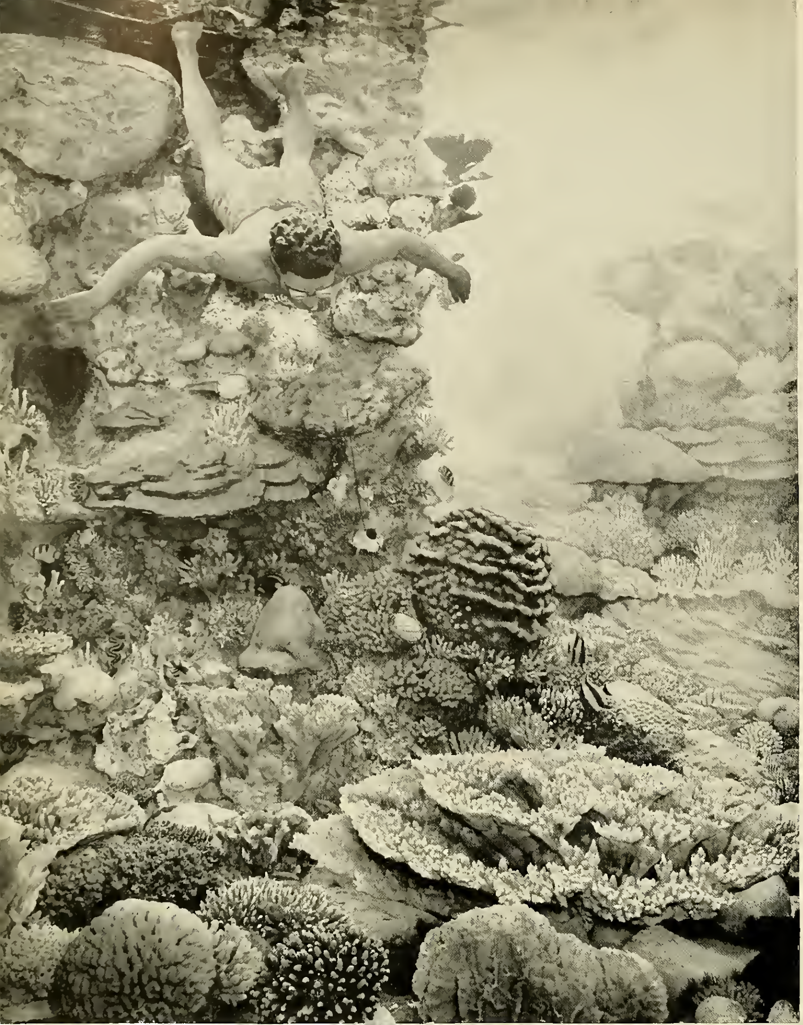
Photo by Toshio Asaeda

AMNH photo by Coles



(Left) A DETAIL of the completed Pearl Divers Group. A native diver, equipped with goggles and simply clothed in a *parieu* twisted about his loins, is detaching clusters of pearl shell from the sea floor at the bottom of a beautiful gorge in the lagoon of Tongareva. Near by, an octopus glides out from a crevice overarched by precipitous walls of fantastically eroded limestone covered with delicately branching growths of coral, alternating with massive domes and grotesquely weird foliations. Brilliantly colored fishes flit in and out of the sea caves

The group was constructed, under Doctor Miner's direction, by Chris E. Olsen and Bruce K. Brunner, assisted by Dr. George H. Childs and Worthington H. Southwick. The life-size figures of the pearl divers were modeled by John W. Hope

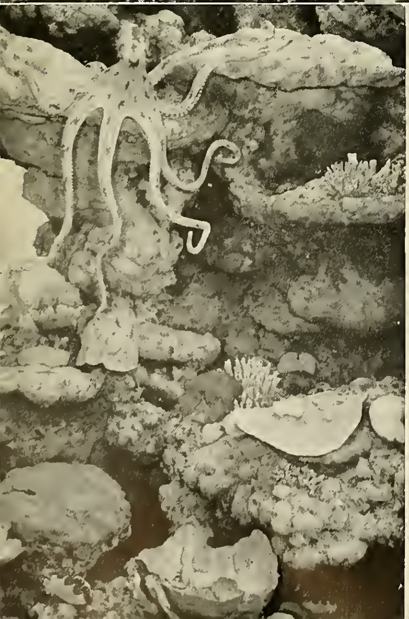


(*Left*) A NATIVE gracefully plunges into the depths of the coral fairyland in search of pearl shell. The spiral turret of the great acropore coral, the prize of the collection, is shown in place in the lower right-hand corner of this view of the finished group

(*Above* and *below*) CAREFUL photographic studies were made of the Tongarevan natives from which the Museum sculptor constructed the life-size figures of the divers

Photos by Toshio Asaeda

AMNH photos by Coles



(*Left*) Through an opening at right side of the Group is depicted a vista through the cavern of the octopuses. A grisly individual is gliding menacingly down from the rocks above

The expedition was made possible by Templeton Crocker and his yacht, ZACA. The group itself is the gift of the late Edith Haggin de Long.

The expedition personnel consisted of Doctor Miner, Wyllys Rosseter Betts, Jr., and Chris E. Olsen.

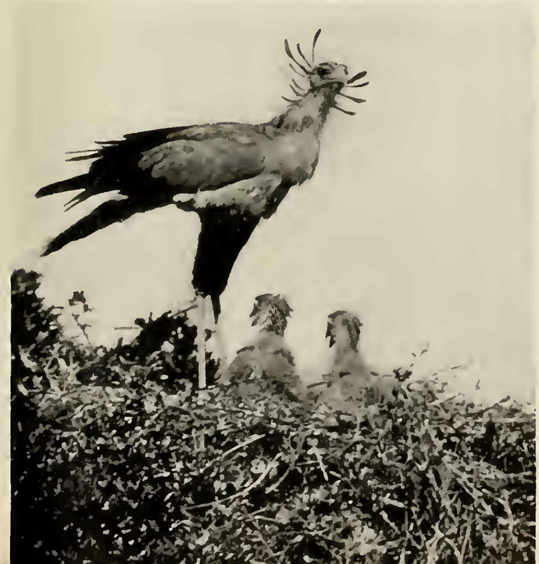
THE "HIDE" from which Captain C. W. R. Knight photographed the family activities that went on in the secretary bird nest visible at right. The nests are usually far more inaccessible and well-nigh impossible to photograph

SNAKE KILLER OF AFRICA

The camera of a celebrated nature photographer catches the secretary bird at the nest with its young,—possibly the first pictures ever taken of this curious creature at home

By CAPTAIN C. W. R. KNIGHT

WHENCE the secretary bird got its name: a pose illustrating the curious elongated feathers at the back of the neck which were supposed to suggest the quill pen protruding behind the ear of the old-time secretary



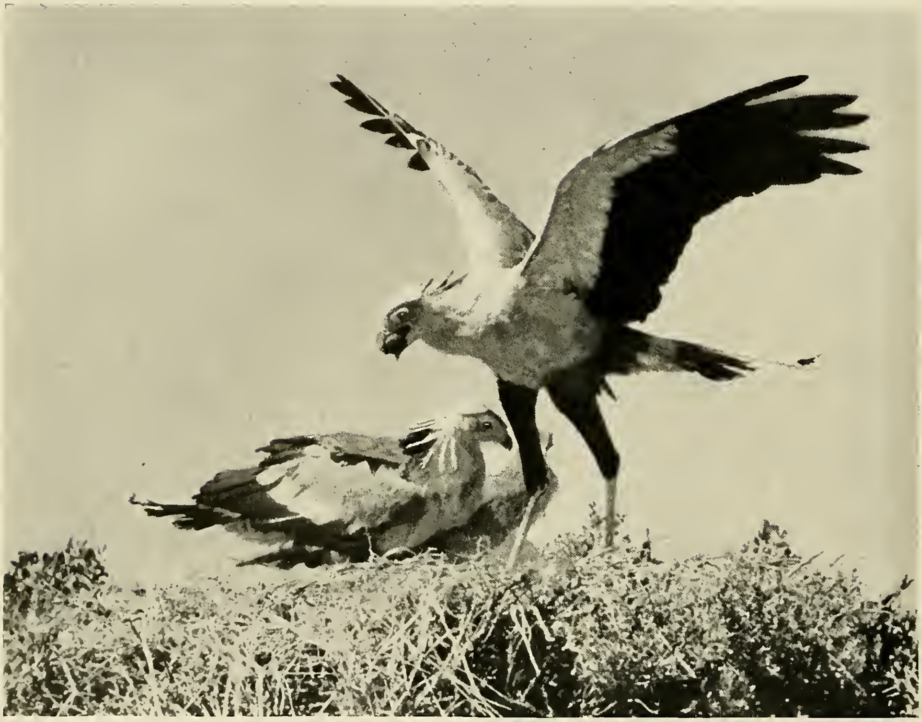
ONE OF the best-known and most interesting birds of Africa, the secretary bird *(Sagittarius serpentarius)*, cannot fail to compel the attention of any intelligent observer, be he ornithologist or layman. This unique bird differs from the eagles and the vultures (to which it is allied) in one curious characteristic—that of killing its prey by forceful and rapid blows or "kicks" of its outspread foot.

In spite of its reputation as a great snake killer—a reputation which, by the way, is fully justified and ought to ensure its survival—the secretary bird is gradually becoming rarer. Egg collectors in various parts of the world, ready to give big prices for its eggs, have fired whole districts with enthusiasm for the treasures. Colored folk have (once to my personal knowledge) wrung the necks of well-grown young ones and taken them home to provide a Sunday roast; while hunters, lacking interest in the bird life of the country and ready to take a crack at any sizable target, will sometimes delight in putting a sudden end to the life of this destroyer of serpents.

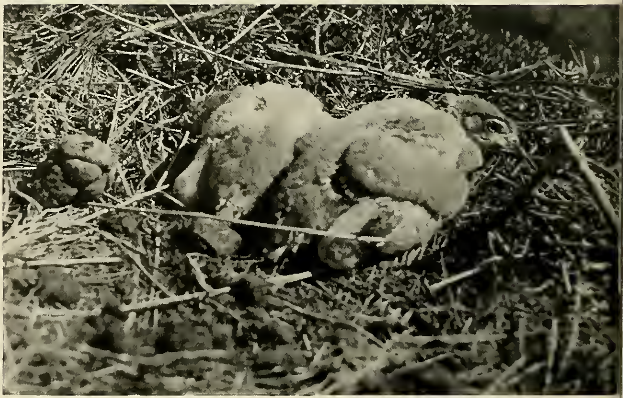
The secretary bird shown in the accompanying illustrations was, indeed, under sentence of death when we first came on the scene, the owner of the land being under the impression that such birds "lived on hares"! Our expostulations and explanations finally convinced him that actually the bird's diet consists of victims small enough to be swallowed whole, such as lizards, snakes, rats, mice, moles, scorpions, or locusts.

Egbert Pfeiffer of New York City and myself, when in South Africa under the auspices of the National Geographic Society, spent three weeks of arduous toil over bad stretches of country before we located this nest. We had, indeed, found three others, but all were in positions photographically impossible, as for example at the top of some isolated tree some 40 feet high. The nest on which we concentrated was in an almost ideal photographic position, and domestic affairs on it proceeded without untoward incident.

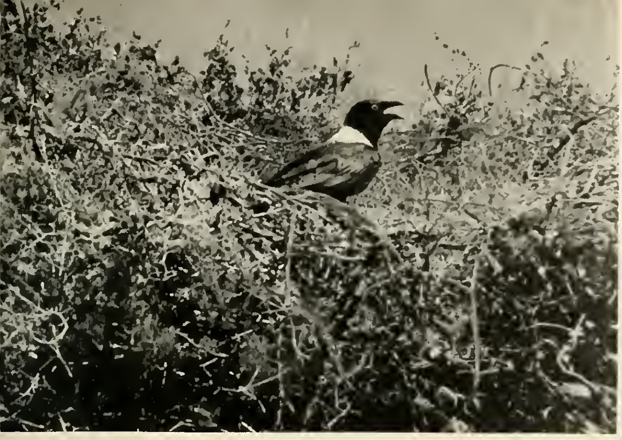
We kept a watch on the young ones for some time after they had left the nest: saw them doing their exercise of jumping upwards with wings flopping sidewise, indulging in longer and higher flights, and eagerly gobbling up the snakes and locusts regurgitated onto the ground by their untiring and devoted parents.



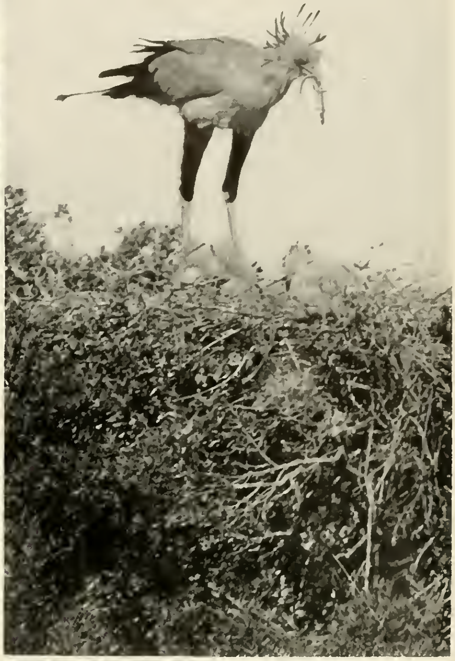
THE SECRETARY BIRD as an interior decorator. Difficult to understand is the habit of the secretary bird of littering its home with pieces of horse dung, much after the manner in which eagles decorate their nests with tufts of greenery. The mature female is shown here bringing the material in her beak



(Right) A CLOSE-UP of the young in the nest. The secretary bird's favorite decoration is here in evidence

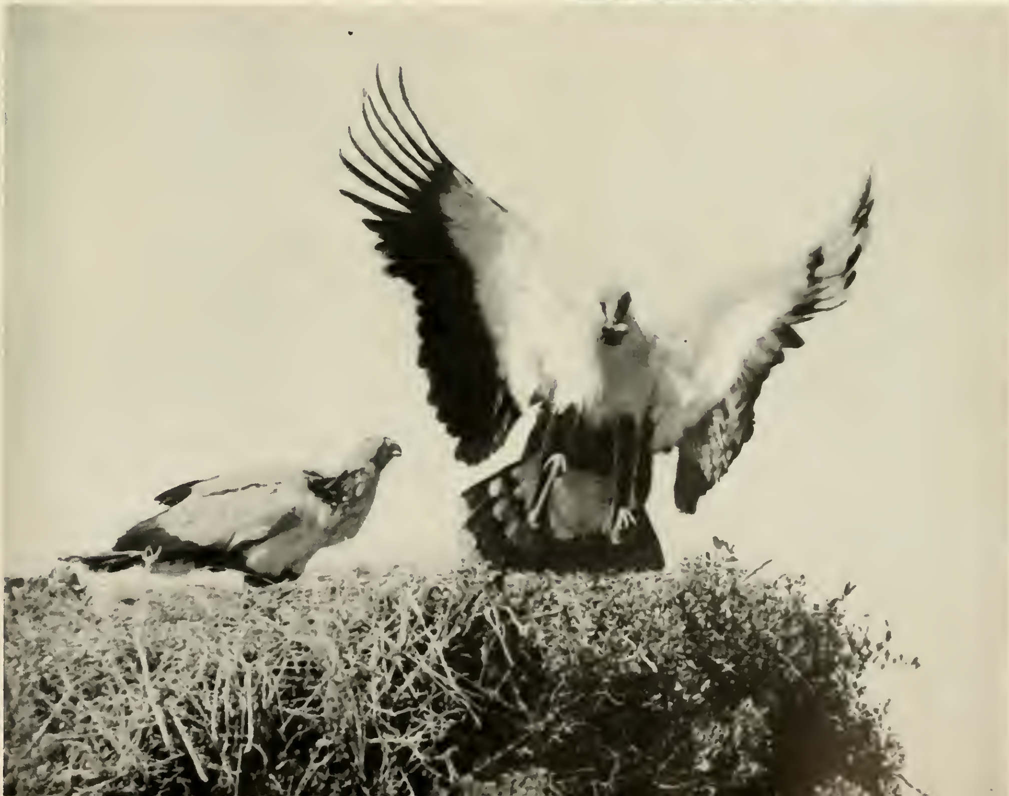


(Above) AN ENEMY of the secretary bird: a pied crow, arriving on the nest to devour the eggs



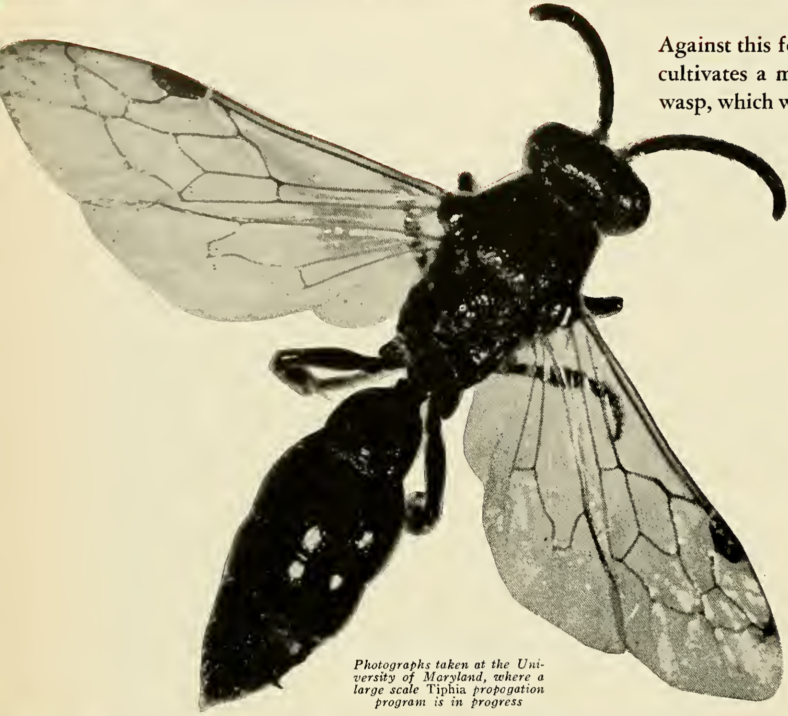
(Right) A LIZARD FOR THE FAMILY. The secretary bird's long legs, so effective in killing prey, enable it to walk extremely fast. The observer may run at top speed, but the bird, apparently without exertion, can easily keep ahead of him

"PUTTING ON THE BRAKES." With huge wings outspread, the returning parent checks its descent and alights on the nest. Flying at immense heights, the secretary bird looks much like a huge vulture with an elongated tail



A tiny army fight

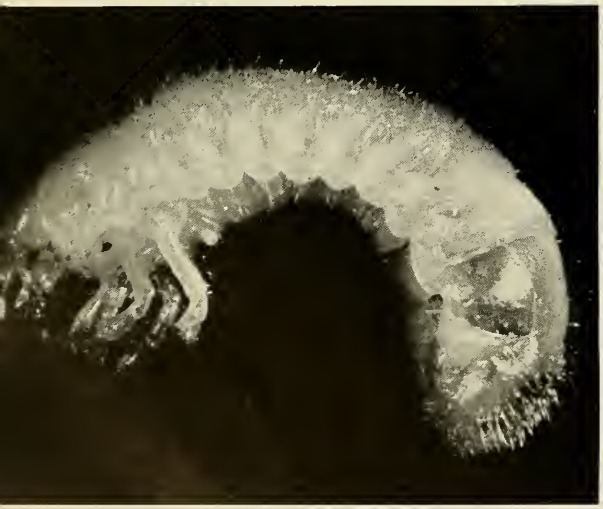
Against this formidable enemy of the garden, man cultivates a mighty ally in the form of a fragile wasp, which wages a curious warfare underground



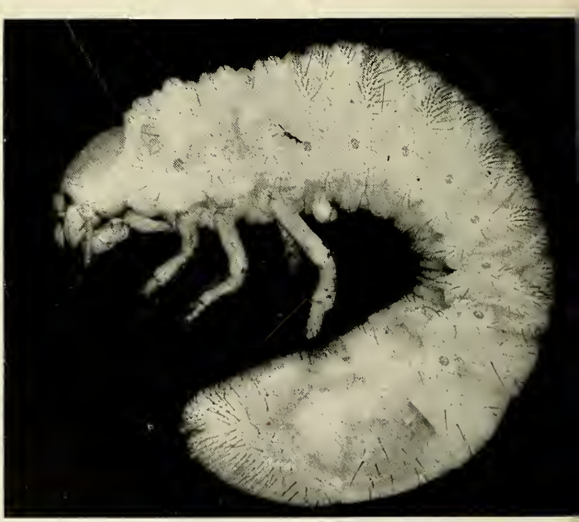
Photographs taken at the University of Maryland, where a large scale Tiphia *propogation program is in progress*

(Left) THE TINY DIGGER WASP *(Tiphia vernalis)* from Korea, which is a natural and deadly enemy of the Japanese beetle: a male specimen much enlarged. Four years of research in the Orient and experimentation with various other potential enemies of the Japanese beetle led to the establishment of this insect as one of the most successful insect allies in combating the pest.

The female wasps emerge from the ground in the spring when the weather gets warm, and burrow into the soil in search of Japanese beetle grubs, on which they fasten their eggs. When the larvae hatch they consume their hosts. Each fertilized female wasp lays in the neighborhood of 60 eggs



THIS is the grub of the unpopular Japanese beetle. The wasp's egg, the white oval object just back of the last pair of legs, is cemented to the body of the grub. The grub is actually about an inch long



AFTER about ten days the wasp larva hatches from the egg. The discarded egg case is seen here still adhering to the end of the larva's body. Though still scarcely larger than a pinhead, the enemy of the Japanese beetle will become almost as large as its host in the next twelve or eighteen days

the JAPANESE BEETLE

By JULIAN J. CHISOLM II

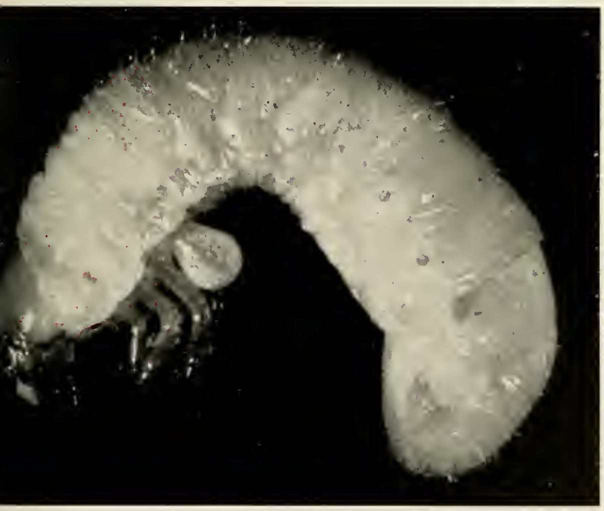
Mother Nature has managed by various means to maintain a fairly even balance of life on the earth since time immemorial. When man steps in, either intentionally or accidentally, and upsets the balance in any region by the introduction of forms of life from other regions, trouble may result.

Many examples of this might be cited, but a specific case which is costing the people of this country millions of dollars is the accidental introduction of the Japanese Beetle *(Popillia japonica)*. For the first few years after its arrival from the Orient the enemy was apparently not noticed. Then in 1916, in the vicinity of Riverton, New Jersey, the infestation was discovered. Unfortunately, the Japanese beetle found conditions in this country entirely to its liking. As it did not have to contend with any of the natural enemies which Nature had provided to hold it in check in its homeland, it proceeded to reproduce in terrifying numbers and is now considered one of our serious insect pests.

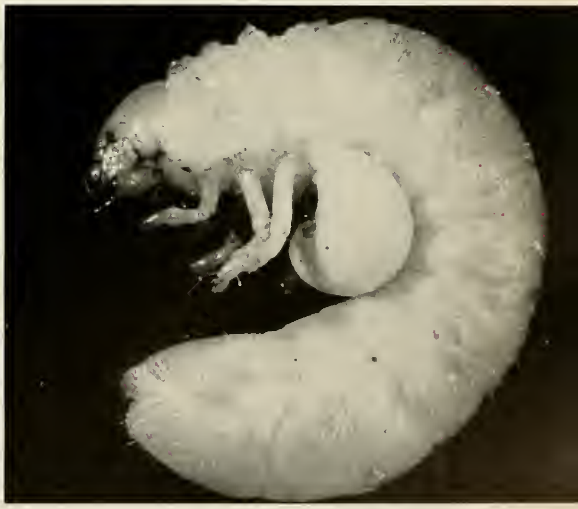
Shortly after it was obvious that this insect would become a major problem, and when normal procedures of insect control were found to be of no avail in combating it, the U. S. Department of Agriculture sent two of its outstanding entomologists to the Orient in 1920. They were to search for natural enemies of the beetle which could be established in this country and would eventually build up a population able to hold the pest in check, without becoming a menace themselves.

After four years of research and exploration in the Orient, a number of insect enemies of the beetle were found, and shipments of these were sent to the United States. Of these, five species became established, among which a certain wasp has so far proved to be the most important. The first shipment of cocoons of this wasp was made in 1924 to the U. S. Department of Agriculture laboratory at Moorestown, New Jersey. The cocoons were carried over the winter in the laboratories, and when the adults emerged in the spring, they were released in colonies in areas heavily infested with the beetles. Importations continued for about ten years, some in the form of cocoons but the majority as adult insects which were released as soon as they reached their destination. Since that time, colonies have become thoroughly established in this country, and these supply the material for propagation of additional colonies for release in other areas.

Tiphia vernalis, as this insect is known scientifically, is a little black wasp scarcely three-fourths of an inch in length, which lays its eggs *only* on the grubs of the Japanese beetle. It is related to the large



Feeding on the grub's body juices, the larva of the wasp has grown during five days to the size shown above



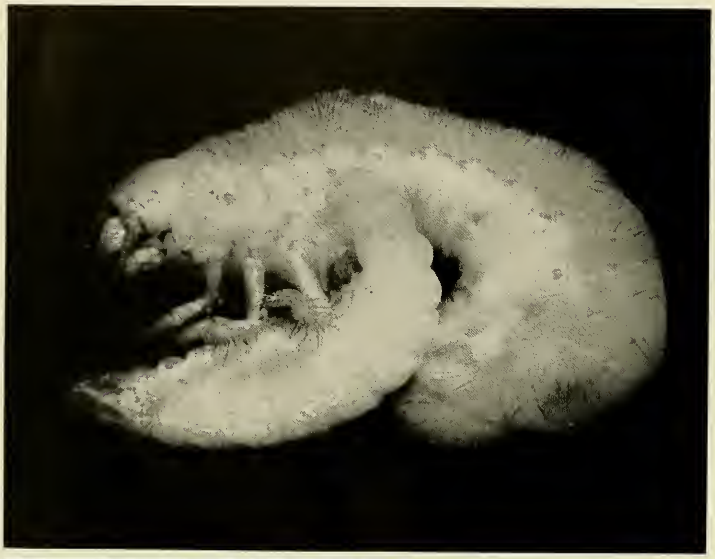
Five days later the larva is nearing the mature stage, when growth is very rapid family of "digger wasps," of which there are many species in the United States. These native species, however, have shown no inclination to extend their operations to include the Japanese beetle.

The life cycle of this *Tiphia* is interesting.

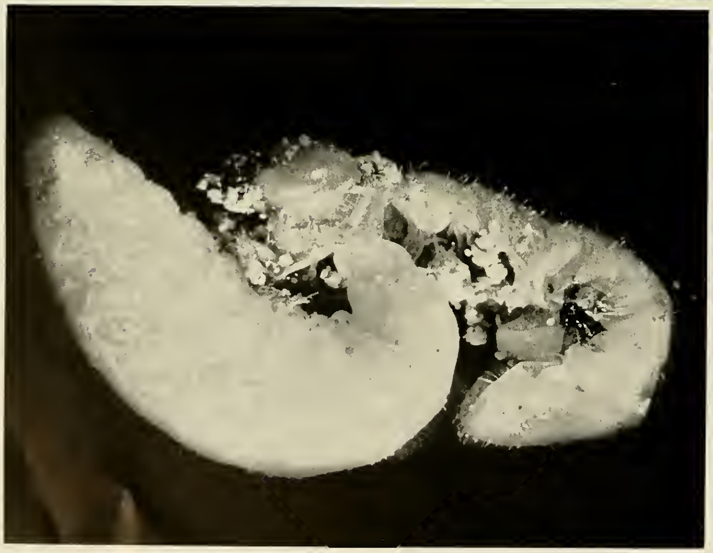
During May, generally from the 10th on, depending upon temperature and other seasonal conditions, the adults emerge from the cocoons in which they have overwintered underground. The insects mate, and the females, with no loss of time, start burrowing through the soil to find the grubs of the Japanese beetle, on which to lay their eggs. In this process the wasp wraps herself around the body of the Japanese beetle larva and with the tip of her abdomen massages an area just back of the last pair of legs. The egg is then deposited upon this massaged area and cemented in place.

Under ordinary field conditions each female parasite lays in the neighborhood of 60 eggs during the period of oviposition, which generally lasts for a month to six weeks. During this active period, the adult wasps feed on the "honey dew" excrement of various species of plant lice, or aphids. Shortly after the last egg is deposited, the female dies, her life cycle completed.

In the meantime, let us go underground and see what is happening to an egg attached to one of the victims. In five to ten days, depending on the soil



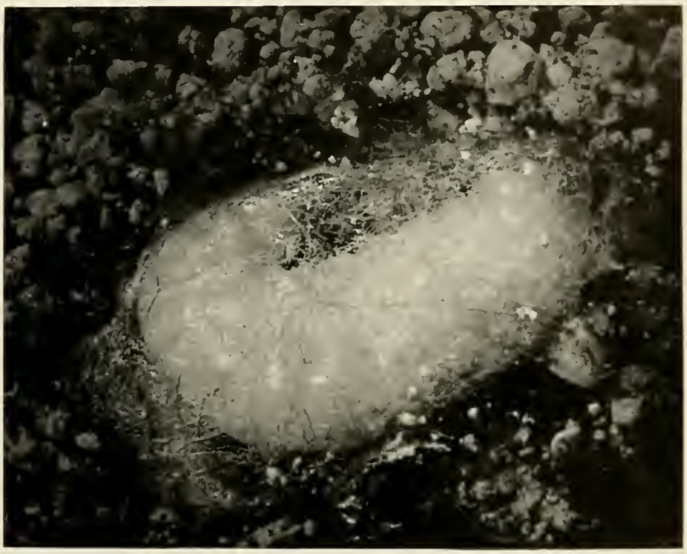
After five more days the larva is almost mature. The sucking habit of the young parasite larva has changed, and the further development of the mandibles enables it in this stage to consume the host, which is now dead



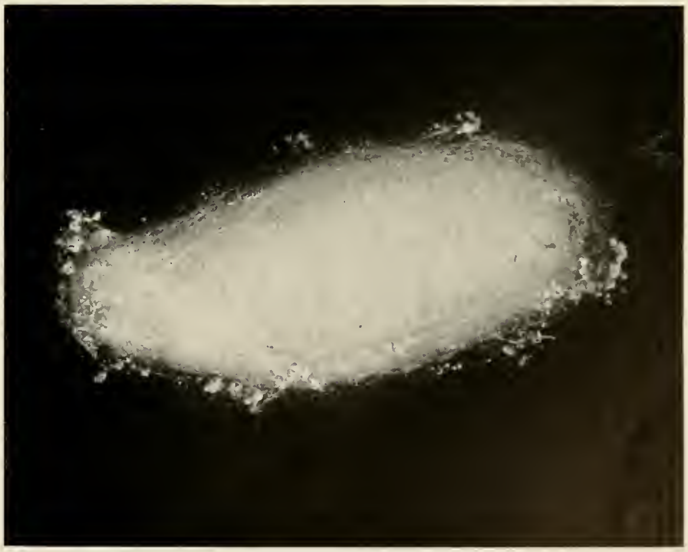
By noon of the next day: all that remains of the Japanese beetle grub. A few hours more and even this will disappear, and the larva will start to spin its cocoon temperature, the young wasp larva hatches and fastens itself securely to its host by inserting its mouth-parts through the skin tissues. The wasp larva at this time is not much larger than a head of a pin, but it has a voracious appetite and by greedily sucking the body juices of the grub, it grows rapidly. In twelve to eighteen days it is almost as large as its host. It is now nearly mature, and the remainder of its growth is very fast. During this period the mandibles become fully developed and are used in literally devouring the host grub, which is now dead as a result of the constant drain on its life fluids, sucked out during the early stages of parasitic growth.

In the course of the next twelve hours, the *Tiphia* larva spins a cocoon in which it subsequently pupates. After a short pupal period, it transforms to the adult and remains in the cocoon throughout the winter, emerging in May to repeat the cycle.

Here the question may arise as to what will prevent this insect from increasing in vast numbers and becoming a nuisance. The answer is this: the wasp population is dependent upon the beetle population, because without beetle grubs there can be no future generations of wasps. As the beetles are killed off, or at least killed down to what may be considered a normal population where their depredations would not be any greater than any other common garden insects, the wasp population will shrink in proportion.

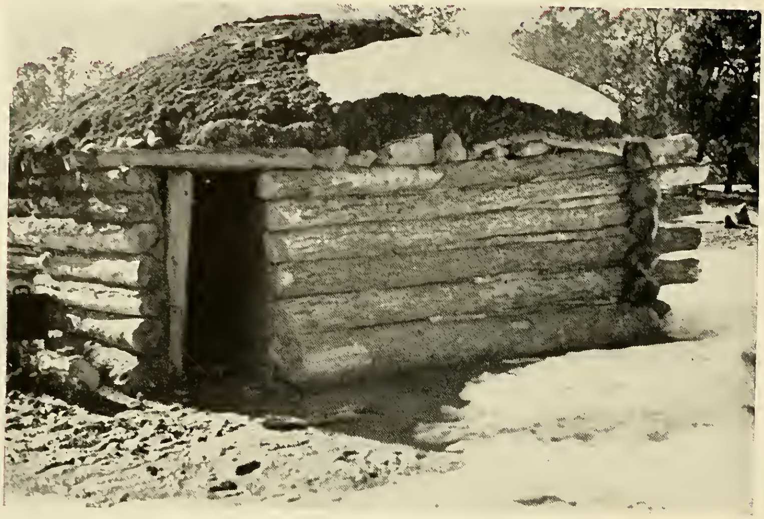


By evening the Japanese beetle grub has been consumed, and the larva which did away with it has started spinning its cocoon



The following morning the cocoon is complete. In this silken case the larva will subsequently pupate. The adult wasp then emerges from the pupa case but remains in the ground in the cocoon until the following spring, when it chews its way out, comes to the surface of the ground, and commences a new cycle in its warfare against the Japanese beetle

A NAVAHO BUILDS A HOUSE



A Story in Pictures

By

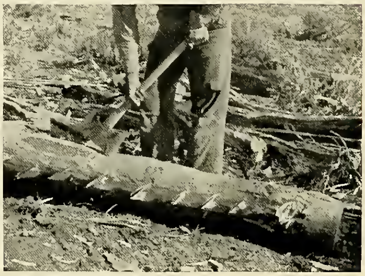
ALEXANDER

and DOROTHEA LEIGHTON

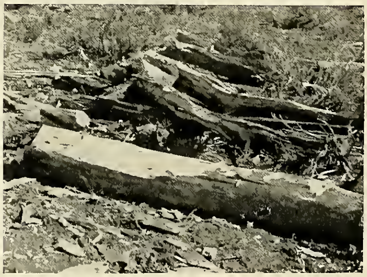
Photos taken while under grant of the Social Science Research Council

1 *(Below)* He wrests the raw materials

2 . . . from the semidesert,

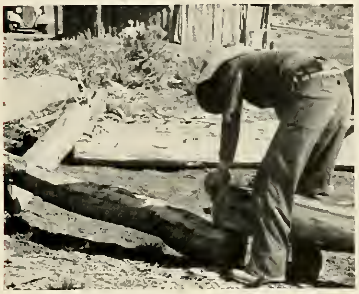


3 . . . and makes a row of notches first

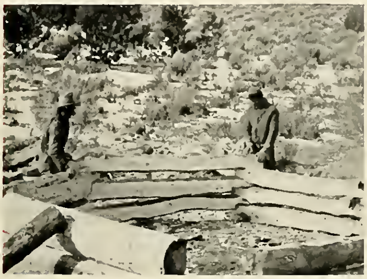


4 . . . to square the logs. Assembling them,

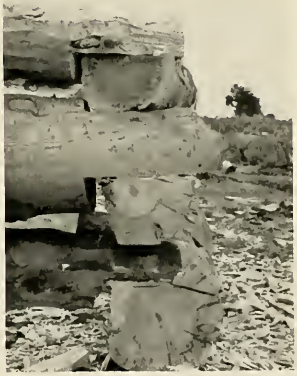
5 . . . he has an interested audience.



6 The walls begin to grow,

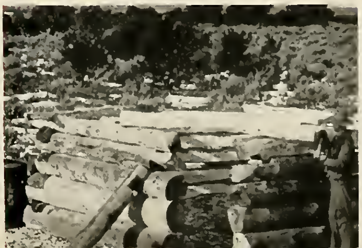


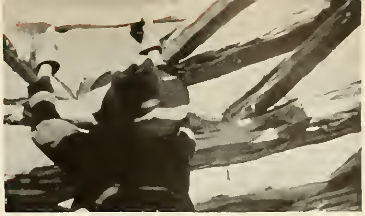
7 . . . as row after row is added,



8 . . . with nice joinery at the corners.

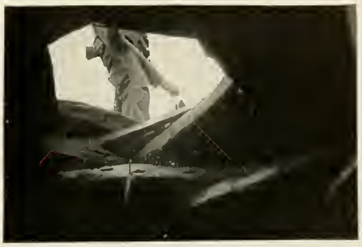
9 The roof starts shoulder-high



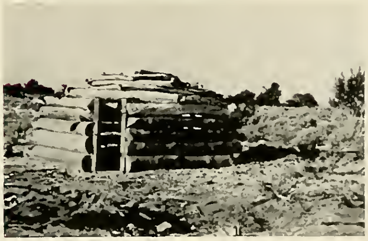


10 . . . and grows from the edges inward.

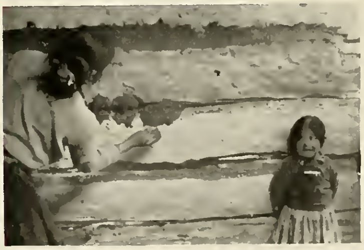
11 A youthful imitator studies Navaho architecture, as the smoke hole in the roof takes shape *(below)*



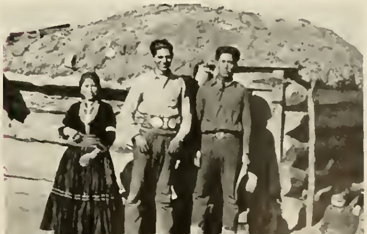
12 Now the house is finished



13 . . . except for chinking with mud

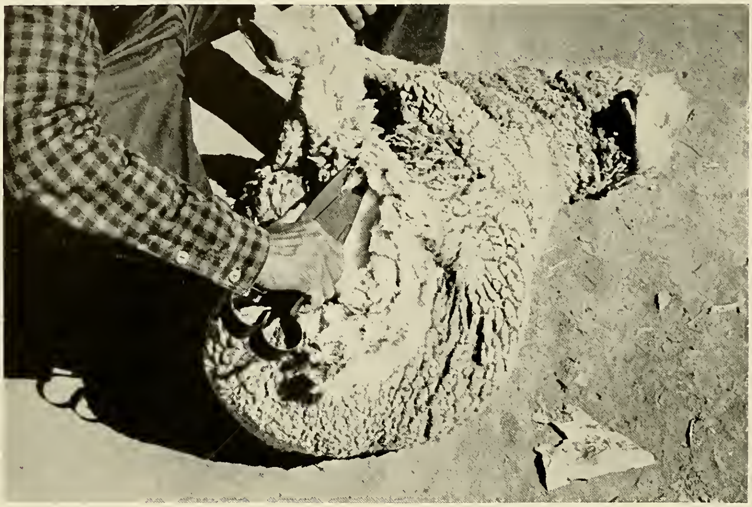


14 *(Below)* Ready for occupancy: the house and its builders

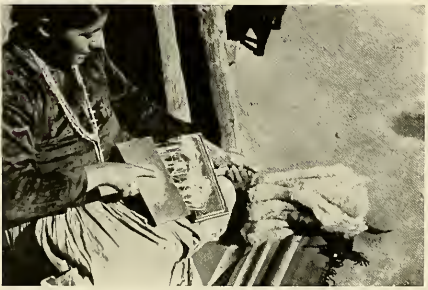


A NAVAHO MAKES A BLANKET

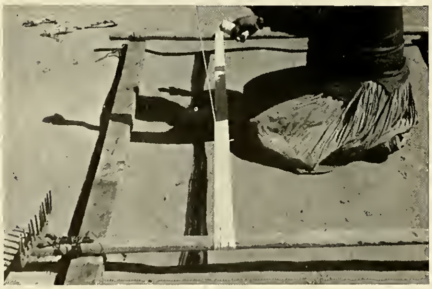
By ALEXANDER and DOROTHEA LEIGHTON



1 After clipping and washing, the wool is carded *(below)*

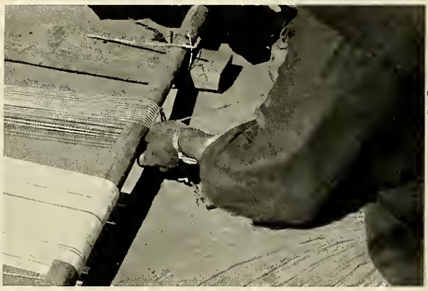


2 Any old frame serves to hold the warp *(below)*

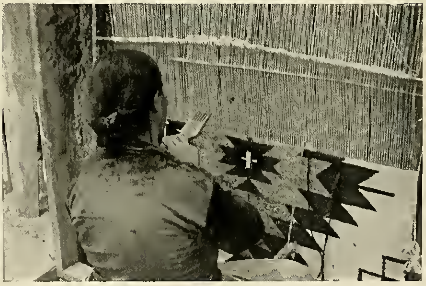


3 . . . which is strung in a figure eight

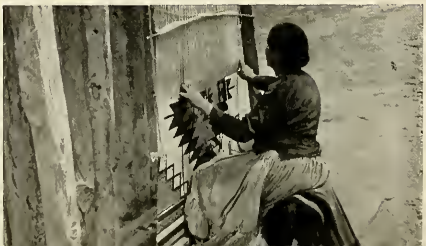
4 *(Below)* The weaver binds the edge of the blanket with wool



5 . . . and goes to work at weaving,



6 pressing down the work with a batten



GEM FOR MAY

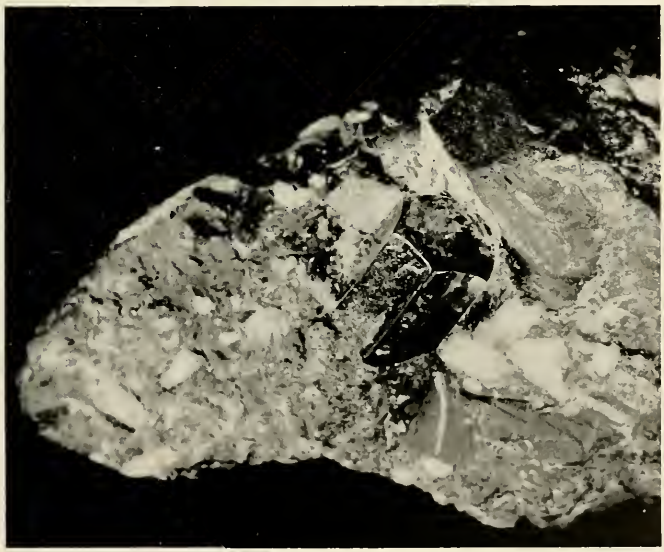
For those who gaze upon the rich green of the emerald, legend promises a panacea for eye trouble

By FREDERICK H. POUGH
Assistant Curator, Geology and Mineralogy, The American Museum of Natural History

UNTIL the Spanish conquest of America, the Old World had never seen a really fine emerald. For the finest examples of this most precious gem come from the mines of Colombia, which were known to the Incas but which thereafter were lost for many years, some even to this day. Even the Spaniards who first found these treasures in such abundance did not appreciate their rarity and worth. The story is told that the conquistadors applied the traditional gem test intended in reality only for the diamond: delivering a hammer blow to a stone on an anvil. It is easy to imagine what must have happened to many fine gems of this brittle and easily fractured mineral. However, the wiser priests are reported not to have tested *their* stones in this fashion. It is said, indeed, that they gathered the broken fragments of the stones discarded as worthless for their own loot. Eventually the true nature of the emerald was discovered, and the world demand for many years was filled from the Inca supply and later by Spanish operation of the mines. Many stones found their way as far as India to be carved and distributed as Indian emeralds.

A perfect six-sided emerald crystal from Colombia

Photo by the author



Emerald is a variety of the mineral beryl, a silicate of aluminum and beryllium. Beryl is the principal ore of beryllium, a light metal too expensive for use alone but of great value in alloys when combined with copper. We have already spoken of another variety of this mineral, aquamarine, but whereas the aquamarine is blue to blue-green, from slight impurities of iron, the emerald is a rich deep green, from chromium. Common beryl crystallizes in six-sided crystals, which sometimes attain tremendous size. Single crystals six feet in diameter and over 20 feet long have been found in Maine. But emerald crystals never approximate even an equivalent number of inches, for there appears to be an internal strain in emerald that results in many cracks and flaws, visible as the so-called "garden." This partial explanation of the small size of the crystals may also be the reason for the relatively greater fragility of the emerald in comparison with other beryl gems.

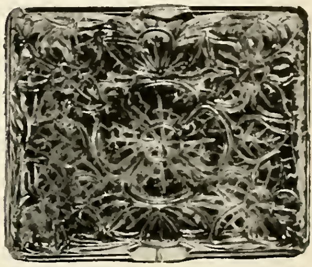
Emeralds are among the oldest of gems, and a mine in Egypt, which produces very low quality stones, is known as "Cleopatra's emerald mine." But apparently they were not abundant in those days either. Though we sometimes see strings of roughly polished six-sided prisms in museum collections, we more often see similarly shaped glass imitations.

Standards of color have changed through the ages, for, contrary to current taste, the ancients preferred light-colored stones. Emeralds were thought to sharpen the wits, to confer riches and, when placed under the tongue, to give the power of prediction; they were also thought to be of great therapeutic value, and formulas for the cure of poisoning by swallowing the powder of this gem were prescribed as late as the seventeenth century. The powers attributed to an emerald can probably be ascribed to the color—just as the powers attributed to the diamond stem from its hardness. Green is thought to be a restful hue, and many references to the use of an emerald to rest the eyes can be found. Gem engravers kept on their tables an emerald at which to gaze when their eyes became fatigued. Nero is said to have watched gladiatorial combats through an emerald, and in view of the superstition it seems quite probable that for once he was not merely indulging his prodigality but endeavoring to aid his eyesight. Water in which an emerald had stood was supposed to cure inflammation of the eyes.

In more recent times several new emerald localities have been found and old ones rediscovered, but even now none can compare with the Colombian deposits, which are still in operation. The gem crystals occur in a soft rock which is dug away in a series of terraces from which the stones are picked out by hand. Some are lost, washed away, or stolen, and the operation is seldom profitable. It is said that chickens, kept by the residents of the mine area, are allowed to wander around where the wash comes out of the mine, because fine stones which would otherwise have been lost are often found in their crops. Apparently, even the chicks have an eye for a good green pebble.

The Schettler emerald. Through probably mined in Colombia, its exquisite carving was done in India

AMNH photo by Kirshner



Deposits have been worked in Russia, where emeralds occur in the Urals with other gem stones; in Africa, where a few fine stones have been found; in the highest mountains of the Tyrol amid scenes of the greatest grandeur, though the stones are poor; and in North Carolina. Our American deposits have never yielded stones of good quality,—most of the crystals are small and are cut in rounded gems, with black and white associated minerals showing, and sold as emerald matrix.

But synthetic emeralds are for the scientist the most fascinating modern chapter of emerald history. Science has perfected a method (though not yet the stones) for the manufacture of this gem synthetically. Unlike the synthetic corundum gems, this compound actually crystallizes much as in nature, albeit in smaller and less perfect crystals. However, true emeralds, like natural pearls and true rubies, will maintain their worth even when man's imitations are made far better than they are today.

Thousands of tourists have watched this amazing ceremony, yet the secret of the Hopi priests, jealously guarded since prehistoric times, remained a matter of mystery and conjecture until an inquisitive snake expert captured one of the sacred rattlesnakes

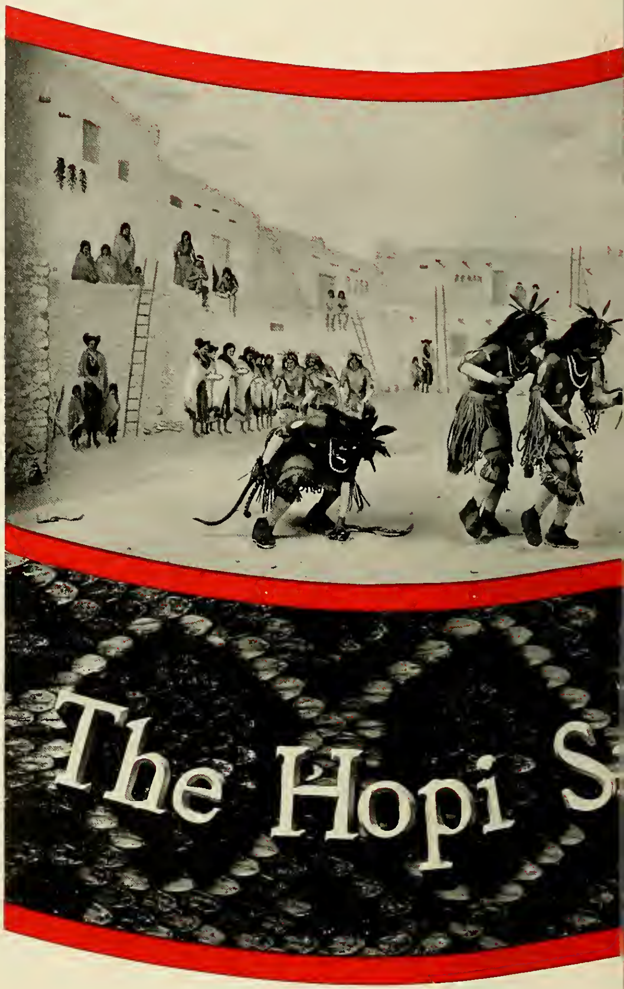
By C. M. Bogert

Assistant Curator of Herpetology,
The American Museum of Natural History

THE HANDLING of venomous snakes publicly may be observed in several parts of the world. Cobras are "charmed" in India, China, and Burma, chiefly as a spectacle or entertainment for which remuneration is expected from the audience. In Africa certain tribes utilize cobras and vipers as well as harmless snakes in ceremonies, the exact significance of which seems not to be well known. Perhaps no more spectacular, but certainly the best known of ceremonies in which snakes are used, however, is the Snake Dance of the Hopi Indians of northern Arizona.

Sixty years ago the first account of the Dance was published, and subsequently literally hundreds of accounts have appeared in newspapers and magazines, or even woven into novels. The details of the ritual have been rather thoroughly studied by ethnologists, who have prepared detailed reports. Only one phase of the Dance remained unexplained,—the ability of the Hopi Indians to handle rattlesnakes without any apparent ill effects. There has been speculation in abundance; every conceivable opinion and many ludicrous ones have been offered. Still the matter has remained largely one of conjecture and opinion.

Therefore, when an occasion arose for me to attend the snake ceremony, I looked upon it as an opportunity to try to settle the question. The dance had been seen by a competent herpetologist, Mr. L. M. Klauber, whose specialty is rattlesnakes. His excellent report* summarized the important and pertinent information that had been printed during more than half a century, and his conclusions were based upon a consideration of all facts available. Still there was something to be desired. No rattlesnake actually used by the Indians in their dance had been secured for examination since 1885 when Yarrow, an early investigator, examined two snakes that were "captured" after the dance; and there was no certainty that his snakes were ones that had actually been used in the final part of the ceremony, where live rattlers are carried suspended from the mouth.



Mr. Klauber had concluded that snakes used in the dance most probably had had their venom extracted, but he had reason to believe that the fangs were intact. Planning my course of procedure from the very complete summary Mr. Klauber had made, I hoped therefore to secure a rattler that I knew had been used in the snake ceremony.

I did not anticipate that this would be a simple

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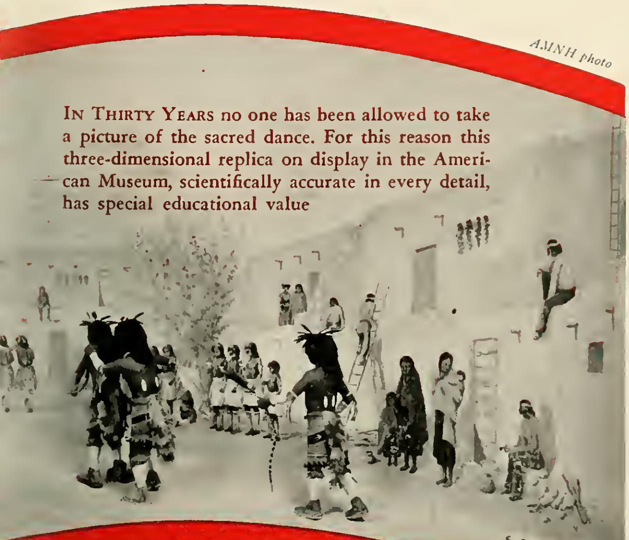
*L. M. Klauber, "A Herpetological Review of the Hopi Snake Dance," *Bulletins of the Zoological Society of San Diego*, No. 9 [1932], pp. 1-93, pls. 1-5.



AMNH photo

In Thirty Years no one has been allowed to take a picture of the sacred dance. For this reason this three-dimensional replica on display in the American Museum, scientifically accurate in every detail, has special educational value

AMNH photo by Bierwert

task. I was acquainted with the Hopi Indians and their villages, located on the three fingers of a mesa that extend southward into the Painted Desert. I was on good terms with several Hopis, and I knew them as a friendly, intelligent, and industrious tribe of Indians. I knew that their Snake Dance was part of a religious ritual, and as such I had no desire to meddle with anything that would offend their sense of privacy. But I did want to obtain a rattlesnake used in the dance.

Some rationalization was necessary. After all I was a collector. Perhaps after the ceremony was finished it might be possible for me to obtain a specimen just as I might have captured any other in the course of the day's field work. I knew that the snakes were liberated as soon as the ceremony was over, and the capture of one of the rattlers that had gone through the ceremony seemed at least feasible. Therefore, I held this notion in the back of my mind when Mr. Glover Ruckstel of the Grand Canyon Airlines proposed a trip by plane to the Snake Dance. It was a mere half-hour's flight to the Hopi villages over an interesting terrain that I knew from below but had not seen from the air. Even if my plan did not work out as I hoped, I knew the trip would be interesting.

Every August there are Snake Dances on successive days during the even-numbered years at Shipaulovi, Shongopovi, and Hotevilla. A small dance at Shipaulovi had taken place the day before we arrived, and the afternoon of our arrival we saw the second dance at Shongopovi. The next day the largest ceremony of the three was to follow at Hotevilla.

What we see as the Hopi Snake Dance is in reality only the culminating rite of a nine-day ceremony conducted by two fraternities known as the Antelope and Snake Societies. The late Dr. J. W. Fewkes called it, "A serious, precise religious rite which has survived from prehistoric times to our present day. . . . No Hopi priest lives who understands the meaning of all the details, nor does he care for an explanation of them. There are two fundamental factors, however, which he can comprehend, and these are always on his lips when an explanation is solicited, 'We cling to the rites of our ancestors because they have been pronounced good by those who know. We erect our altars, sing our traditional songs and celebrate our sacred dances for rain that our corn may grow and yield abundant harvest.' "

Contrary to first accounts published in 1881 and 1883 and to later popular, impressionistic, and often inaccurate accounts, the rite is not snake-worship. Rather, the serpents, gathered from the fields, are looked upon as messengers intrusted with the prayers of the people, and after the dance they are liberated to " . . . bear these petitions to the divinities who can bring the blessings of copious rains to the parched and arid farms of the Hopi."

The Hopis have other equally important ceremonies, but owing to the use of reptiles in the public part of the Snake Dance, it has become one of the most widely known religious rites practiced by a primitive people. The liquid consumed by the priests after the dance has been supposed by some to be an "antidote." But it is clear that it should not be called an antidote, for the Indians themselves do not claim any physiological action for it. Mindeleff pointed out this fact in 1886. The Indians prefer to consider the action one of witchcraft: it is not the liquid itself but the chants and ceremonies whereby it is consecrated that render it effective. Many arguments have been waged over the methods by which the Indians handle the venomous snakes without serious consequences; what we wanted to find out was whether they defang the snakes or not.

Four days of the nine-day ceremonial are devoted in part to snake hunts in the four cardinal directions —north, west, south, and east, always in the order given. Other days are given over to the consecration of *kivas*, or underground ceremonial chambers, to the making of a charm liquid by the Antelope priests, and the making of *pahos*, or prayer sticks (usually sticks to which are fastened eagle feathers, cornhusks, packets of sacred corn meal, etc.). All of this is accompanied by the singing of traditional songs, many of which contain words foreign to the present-day Hopi language.

Besides these secret rites there is a public "Antelope Race," a "Corn Dance," a "Snake Race," and lastly, the "Snake Dance," followed by the taking of the ceremonial emetic. Feasting and merrymaking close the celebration.

Sacred

Despite their poorness in worldly goods the Indians have resisted all attempts of the white man to commercialize their ceremonies. Considerable sums of money reputedly offered for movie rights have been refused, and for the last 30 years no cameras have been allowed on the mesa while the dance was in progress. Unfortunately, some present-day visitors are inclined to look upon the ceremony as a sort of vaudeville show. Yet the dance is part of a religious ceremony, and how annoyed we should be were a group of Indians to attend one of our churches with the same spirit!

When we arrived on the top of the mesa, we left our cars on the outskirts of the village and wandered in toward the plaza. Although it was still early, crowds were beginning to gather. Even a few Supai Indians had ridden all the way from the west end of Grand Canyon, nearly 150 miles, to see the ceremony. Navahos on horseback were arriving in small groups, others were in wagons that clattered and squeaked as the horses toiled up the narrow road to the mesa top. Once the enemies of the Hopi, the Navaho Indians have been forced by the white man's rule into comradeship, although a present-day saying of the Hopi, "Food draws flies and Navahos," is indicative of the Hopi's feeling of superiority.

We continued toward the plaza, hoping to get in a good position, for I wanted if possible to obtain data on the kinds of snakes used. Already the plaza was lined with people. At one end was a conical bower of cottonwood boughs with a white cloth over the entrance, the *kisi*, where the snakes were to be deposited in bags prior to the dance.

The housetops and windows surrounding the plaza were filled. Several Hopis came through carrying a long forked log. A commotion on a housetop revealed that this wood was being rushed to reinforce the bracing where a roof was sagging from the weight of 40 or 50 Indians in the "grandstand."

At least 700 people had gathered, 50 to 75 per cent of whom were Indians, and color was rampant. There were Indians in all possible as well as some impossible garbs. An old, gray-haired Hopi sat in a dignified manner on a doorstep, wearing for headgear an old-fashioned, blue, broad-brimmed, lady's straw hat decorated with varicolored grapes and artificial flowers.

Navahos meeting friends gravely shook hands, spoke a few words and remained silent, waiting. A tourist offered an Indian a cigarette. The Navaho took two, put one in his mouth and the other in his shirt and held out his hand for a match. Many other Indians approached and quietly and with dignity received their quota of cigarettes. The tourist looked disgusted, then smiled and handed the package to the Navaho, who grinned knowingly. The Navahos inhaled deeply and contentedly expelled streams of smoke from their nostrils.

There were several dude ranchers in blue jeans, cowboy hats, high-heeled boots, and large silver-concho belts—New Yorkers, Californians, and Missourians "gone western." There were Harvey bus drivers in brown riding breeches, bright-colored shirts, and neckerchiefs, and Arizonans from the closer towns, Holbrook, Williams, and Flagstaff. A middle-aged Indian woman, with yellow hair and white skin, attracted only slight attention as she walked through the crowd, perhaps because she was not recognized by most of the white people as an albino Indian.

The snake dance begins

Navaho and Hopi policemen moved about the plaza, mildly urging people to take places near the walls and those in the front row to sit down. They cleared an opening in the corner to the right of the *kisi*, and the audience gradually settled and became quiet.

There was a hush. Into one corner of the plaza came the Antelopes led by the Antelope Chief, who carried the *tiponi* or badge of office which for the last eight days had hung on the ladder leading into the Antelope *Kiva*. Fantastically costumed and painted, they marched into the plaza, fourteen of them, including two youngsters, neophytes, bringing up the rear. Four times they made a circuit of the plaza passing before the *kisi,* where each stamped violently with his right foot on a board covering a hole, the *sipapu,* symbolic of the entrance to the underworld.

After the fourth time around they lined up facing away from the covered entrance to the *kisi* and started their chant, shaking white rawhide rattles held in each hand.

The Snake Priests entered, sixteen of them, walking rapidly with a determined, more impetuous gait than that of the Antelopes. Four times they proceeded around the plaza led by their chief, an old, gray-haired, stocky, broadly-proportioned priest. Like the Antelopes, they stamped upon the board covering the *sipapu* and then lined up facing the other Society.

Following this, the Snake Priests, with their arms extended below their hips, clasped hands and leaned forward, swaying to a low chant, which was alternated with a shaking of the rattles by the Antelopes who remained erect. This continued for several minutes. The Antelopes then stepped back, seven men in line on each side of the bower of cottonwood boughs. One Snake Priest got down on his knees, lifted up a corner of the cloth over the entrance to the *kisi,* and crawled inside.

The snakes are produced

The other members of the Society divided into threes, one of each trio moving out into the plaza, the remaining ones, in pairs, lining up to the right of the *kisi.* A priest on his knees pushed his head and shoulders under the cloth and came out with a fair-sized serpent. It was a snake belonging to a stunted race of the prairie rattlesnake, now named *nuntius* or "messenger" in allusion to its use in the Hopi Dance. The priest rose to his feet and placed the snake in his mouth, grasping it in his lips and teeth a third of the way back from the head. His comrade, the "hugger," placed a hand on his shoulder, and together they began a shuffling dance around the plaza. The rattler, its tail hanging sinuously, moved its head from side to side as the "carrier" danced. From time to time the hugger reached in with a two-shafted feather wand, the "snake whip," and gently brushed the reptile's head away from the carrier's face.

Followed by the hugger, the carrier of each of the five pairs was now dancing about the plaza, with a snake held in his mouth and supported by the hands. Three or four times they passed the *kisi,* and then one snake was placed upon the ground, its head directed away from the *kisi.* Thereupon it started to crawl—toward the audience. There was some confusion, and people in the vicinity prepared to move back. Other snakes were soon placed upon the ground; one was an exceptionally large bull snake. A rattler coiled but was brushed with a wand by one of the men not dancing, a "gatherer," who picked up the snake by the middle as it started to crawl off.

Snakes were being received at the *kisi,* others were being carried, several were on the ground being watched by the gatherers, all in more or less confusion. Unnoticed by the Snake Priests, a large rattler crawled toward a woman in the front row. She shrieked and threw her purse at it. The audience was noisy—some people were laughing, but the general feeling seemed to be one of nervous excitement.

I kept count of the snakes in my notebook as each snake was received from the *kisi.* Finally there seemed to be no more rattlers, and all the dancers were carrying long, yellowish-blotched, bull snakes. One snake, different from all others, came out of the *kisi* in the mouth of a dancer. It seemed to be a western glossy snake *(Arizona elegans),* a species not previously recorded in the dance. There were apparently no more snakes in the *kisi,* and I glanced at my notebook. I had a record of ten prairie rattlers, three Great Basin racers, nine Arizona bull snakes, and the one glossy snake. The gatherers were each holding three or four snakes, and some of the Antelope Priests had a few.

The snakes are freed

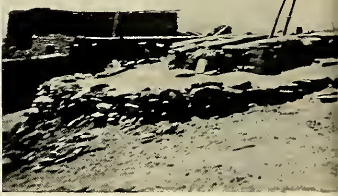
The last snake was finally picked up at the *kisi.* A priest drew a ring with sacred corn meal on the ground, sifting the meal dexterously through his fingers. The Antelope Priests, who until now had been holding the serpents, placed them in the center of this circle, a writhing mass of sinuous, shining bodies. Some Hopi women came forward from the crowd and sprinkled more sacred meal on the snakes. Suddenly there was a quick movement, and the Snake Priests hastily seized as many snakes as they could. They dashed out of the plaza and down off the mesa in the four directions, to snake shrines where the serpents bearing their messages were to be liberated in the rocks.

We watched the dancers as they fled from the summit of the mesa. It was after sundown and the surrounding desert was a glorious sight. A few cottony clouds still caught the sunlight, but within another hour we knew that it would be too dark to attempt to find the snakes after they had been liberated. Nevertheless, haste was impossible, and we wandered

(Left) AN AIRPLANE brought the travelers from the Grand Canyon to see the Snake Dance. Uppermost in everyone's mind is the question of how the priests can hold the venomous rattlers in their mouths with impunity. The author of the accompanying article lingered after the rest of the audience had left and found a surprising answer

Photo by Grand Canyon Air Lines

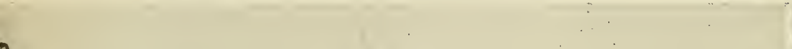
(Below) WARY of their age-old enemy, the Navaho, the Hopis built their villages on mesa tops long before the coming of the white man



(Below) THE ANTELOPE PRIESTS in full ceremonial regalia, preparing to enter the plaza for the Dance

(Below) THE SNAKE PRIESTS enter, with the Antelope Priests already in line before the cottonwood bower or

Photos by Courtesy of Arthur Woodword



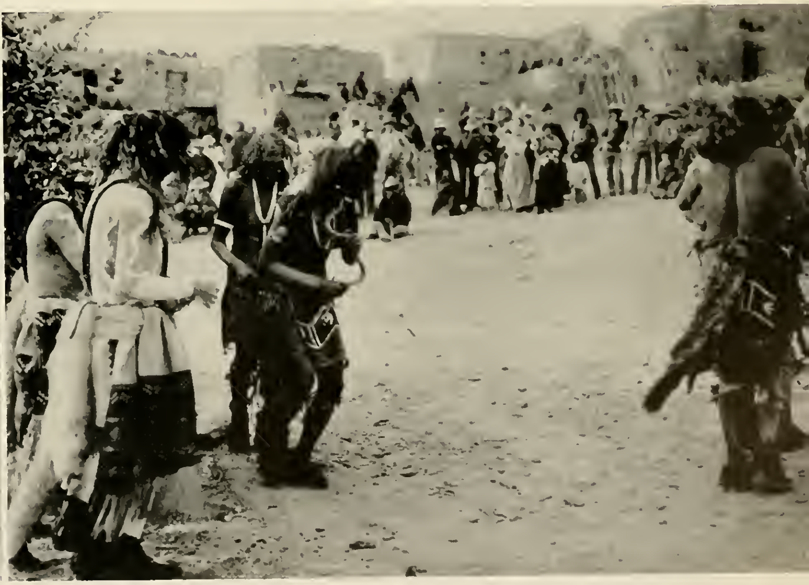
(Right) Meat is hung out to dry in front of this Hopi dwelling, in keeping with ancient custom. These red men are among the few tribes who have resisted white culture with any degree of success. Reputedly they have turned down several Hollywood offers for film rights to their ceremony

The Ladder *(left, below)* leads to one of the underground ceremonial chambers or *kivas,* where secret rites of the Snake Ceremony precede the Dance

Typical three-story Hopi houses are shown below

Photos by H. C. James

kisi where the snakes have been placed prior to the Dance. The 41-year-old photograph at *lower right* shows a priest with a rattlesnake in his mouth. In the other pair of dancers the "hugger" conceals the man with the snake



casually out to the edge of the mesa where a suitable vantage point enabled us to follow the course of three Snake Priests, who were still running with their slender burdens hanging from each hand. Using a small monocular telescope I was able to follow their movements even after they were three or four hundred yards from the foot of the mesa. I saw them head for a group of sandstone rocks larger than others in the vicinity, and soon it became apparent that these were to serve as the shrine where their messengers were to be liberated.

The priests spent a few minutes at the shrine, and though I could barely make out their movements through my telescope, I suspected from what I could see that they were placing the snakes in crevices in the rocks. When they had finished their task and turned toward the mesa, my companion and I climbed down the rocks at the edge of the mesa to follow the same trail that the priests had taken, and we headed down the slope. Other people, both Indians and whites, were leaving the mesa by the same route, and we moved along no faster than they. In a few minutes, we met the returning priests, dogtrotting up the hill and they passed without glancing at us, panting and perspiring. Both Hopi and Navaho Indians were scattered about the foot of the mesa, some of them harnessing their horses to wagons or saddling their mounts, while others were already setting out across the desert.

To avoid discovery

Hastily considering the situation, we concluded that it might be better if we did not go directly to the shrine, which was about a hundred yards to the left of the best-traveled wagon road leading from the village. Instead, it seemed more prudent to take a circuitous route, following the road for only a few hundred yards and then swinging over to the left and cutting back to the patch of rocks where we knew the snakes had been left. In doing this we encountered several small gullies, and after we had walked far enough away from the road and turned again toward the mesa, we emerged from one of these gullies to find ourselves a trifle confused. Where we had seen only the one conspicuous group of rocks, there now were several that seemed equally prominent. Nevertheless, we worked our way toward the village, and at last got our bearings well enough to be reasonably certain that we were approaching the shrine.

When we reached the rocks, however, we could find nothing. We moved about among the huge blocks of the sandstone outcrop, scrutinizing everything carefully, until at last we came upon a *paho* or prayer stick thrust into the ground and, like other paraphernalia used in the dance, sprinkled with sacred meal.

Now, at least, we knew we were in the vicinity of the liberated snakes. Still we saw no sign of them and at this juncture we looked up to see a Hopi staring at us intently from a distance of 30 or 40 feet. Abruptly we lost interest in snakes, and our attention was as suddenly drawn to the scraps of pottery that lay strewn about the ground here as elsewhere in the adjacent desert. The Hopi continued to watch us as we moved away from the shrine, continuing our interest in ceramics, but he seemingly concluded that we were harmless gatherers of souvenirs and went on his way.

Waiting until he was well out of sight, we again wandered back to the place where the *paho* was thrust into the ground. This time I chanced to glance upward from the ground, to which I had previously confined my scrutiny. There in a narrow crevice was a snake, its head downward and its coils drawn together so that it held itself in the crack some four feet from the base of the rock. Observing that it was a bull snake, I seized it by the tail and withdrew it. Immediately below in the crevice I could now see the coils of a second snake, obviously the snake that I sought, since the rattles on its tail were clearly visible. Hastily I liberated the bull snake, and drew forth a stout denim sack that I had carried in my pocket. With little trouble, I seized the tail and extricated the rattler from the crevice. Using a stick that we had selected on our way over to the shrine, I held the snake's head against the rock and obtained a safe grip on its neck. My companion held the sack open, and I gently dropped the snake into it, tying the sack securely with the string attached to it.

Fortunately the rattler was not a large one, not more than 30 inches in length, and it was no great bulk to carry. Nevertheless, I felt a trifle uneasy carrying the sack, knowing that Indians inevitably would be encountered. I had no desire to have them know that I had collected one of their messengers. I felt certain that the Indians, as well as I, would be happier if they did not see me with it. As a matter of fact, I seriously doubt whether any of them would have guessed what was in the sack, but in my feeling of guilt I decided that it was best to carry it where it could not be seen.

Snake in the hat

Therefore, I rolled the length of the sack around the rattlesnake and stuffed it into the crown of my hat. The hat no longer fit very snugly on my head, but it was possible to carry the snake there, and with a feeling of satisfaction, we turned to retrace our steps, away from the mesa and the shrine.

When we had reached the sanctum of a deep gully, the thought occurred to us that it might be wise to examine the snake immediately, just in case anything were to happen later that might make this impossible. Therefore, we removed the snake from the sack, and again obtaining a grasp on its neck, we induced it by use of a pencil to open its mouth. A hasty examination showed *no fangs to be present*. Even when the point of the pencil was pushed under the fang sheath, no fangs could be demonstrated. Satisfied with this hasty examination, we returned the snake to the hat and in the dusk hastened back to camp.

Conditions that arose the next day made it impossible for me to return to the city for several days. The rattler was examined from time to time, and it seemed to be in a good state of health, active but not so inclined to strike as a normal rattlesnake would have been. Two weeks after its use in the dance, the snake, still alive, was forwarded to Mr. Klauber in order that he might examine it in as nearly as possible the same condition as when used in the Snake Ceremony. In response to my request he killed the snake and preserved it. As an alcoholic specimen it was more thoroughly examined, and an amazing discovery was brought to light. Not only were the functional fangs removed, but the embryo fangs as well had been skillfully cut from the jaw so that the snake was made permanently and completely safe to handle. The venom glands were still intact, but without fangs the danger of any venom being injected into one was almost nil. Such a snake would inevitably die, since venomous snakes possess fangs primarily for the purpose of securing their prey. A rattlesnake without fangs would be as helpless as a chicken without a beak, since it is not a constrictor and, therefore, could not kill rodents upon which it normally feeds.

An amazing skill

It remains an astonishing fact that the Hopi Indians are sufficiently well acquainted with the anatomy of the rattlesnake to remove so skillfully the reserve fangs. Few people, even among those who habitually handle rattlesnakes in circuses or in carnival shows, are aware of the fact that all venomous snakes periodically shed their fangs and that merely breaking off the functional fangs does not render the serpents permanently harmless. This ability of the snakes to grow new fangs has been voiced as a logical objection to the theory held by some (who claim to have been told by the Hopi priests themselves) that the rattlers merely had their fangs torn out at the time of capture.

So we may give these Indians credit for having considerable practical knowledge, knowledge perhaps gained by an observing Hopi several centuries ago. Anyone might readily observe the series of replacement fangs if he examined the skeletal remains of a rattlesnake carefully enough. But few people pause to make careful observations, or to interpret them correctly, and, for that matter, it is only within the last decade that the scientific literature dealing with the mechanisms of fang succession has given a very clear, or even a moderately complete, picture of the process.

Native methods elsewhere

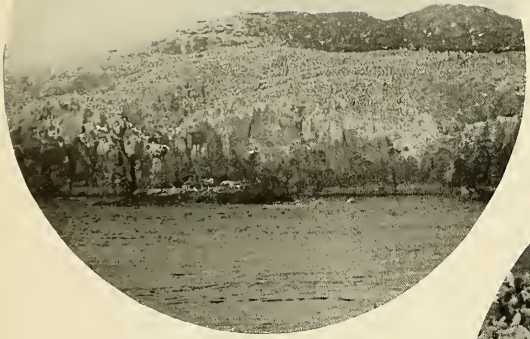
On the other hand, much of the fundamental knowledge of the venom apparatus of snakes seems to have been utilized by peoples in other continents as well. Recently, while studying the fangs of Asiatic cobras, I found that snakes purchased from Hindu fakirs had been as completely defanged as the rattler taken at Shongopovi, whereas those secured in the field by the museum's collectors all contained the normal complement of fangs.

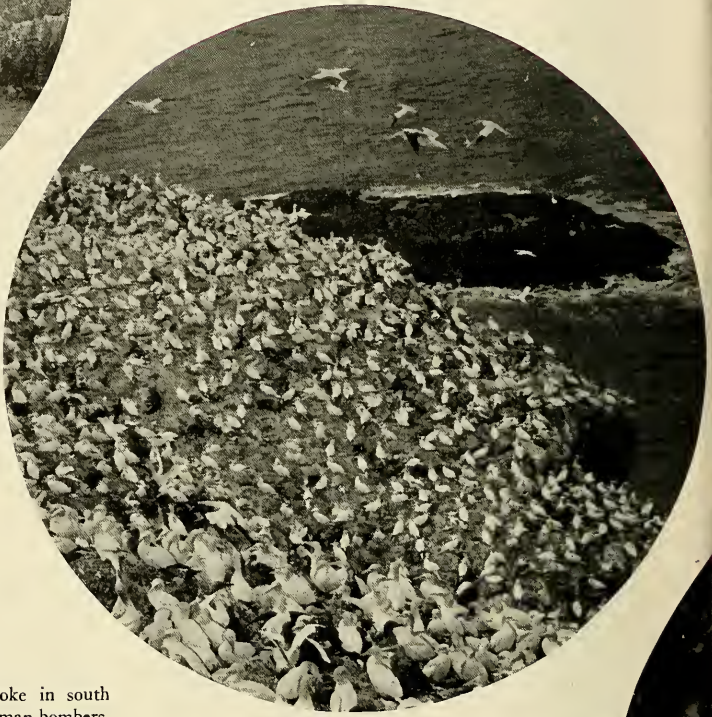
At Harvard's Museum of Comparative Zoology, through the interest of Mr. Arthur Loveridge, I have also had the privilege of examining an African night adder, the donor of which stated that, after undergoing "immunization" as practiced by one of the African snake cults, he had been bitten by it without ill effects. This snake likewise proved to be completely devoid of fangs. While I have no doubt that the man who returned with the viper that bit him sincerely believed that he was immune to snake venom, his "immunity" was as much a myth as the ability of the Hindu to "charm" his cobras.

There is but one completely safe method of handling venomous snakes. This consists in putting out of commission some essential part of the venom apparatus. It is possible to do this in several ways. The mouth may be sewed closed, and the stitches carefully concealed, thus preventing the snake from biting. This method has been reported in Africa and Asia. The removal or destruction of the venom glands or portions of the venom ducts has been accomplished on living snakes, but the procedure is difficult, and there are no authenticated reports of primitive peoples utilizing this method. Finally, the simplest way to make it practically impossible for a venomous snake to defend itself consists in removing all of the fangs, and quite probably this is the method most commonly employed. At least we know that the Hopi, the African native, and the Hindu skillfully employ this technique.

ENGLAND

By Winifred Comstock Bowman





(Above) **Grassholm Island** and its "gannetry" seen from the ocean. When approached by humans, the great white mass of screaming, fluttering birds add squawks of terror and indignation to the general bedlam. Twelve miles off the Welsh coast, this tiny speck of land is within earshot of the bombing raids on Pembroke. *(At right)* A close-up of this well-populated sanctuary

Photos by R. M. Lockley and Bowman

For many months now, Pembroke in south Wales has been a target for German bombers. In this new existence of mine, exiled by the war from a country where I have lived for fifteen years, place names and the memories they evoke are my one reality. So it is that the mention of Pembroke and Milford Haven in the German communiqués brings back vividly and persistently to my mind a holiday my husband and I spent on the little island of Skokholm in 1937. It is difficult now to realize that the tiny peaceful island lies near enough to the English naval base to have its quiet shattered by the roar of the German bombers as they swoop toward their objective a few miles distant; and that the thunder of bursting bombs sends the colonies of puffins and shearwaters wheeling into the air with answering cries. For Skokholm is a bird sanctuary.

One night in 1937 my husband and I saw a film called *The Gannets,* with a commentary by Julian Huxley. It was a study of the island of Grassholm off the coast of south Wales, an island which is inhabited solely by a huge colony of the great sea birds called gannets. This film was beautiful and interesting and made a great impression on us. My husband has always been interested in birds and their ways, and eventually he suggested that we, too, visit the island, and perhaps take some films of our own. We had recently acquired a small movie camera, and since color films had just then become fashionable, we would take our films in color.

I must say here, that in common with most Americans, I knew very little about birds—and, unlike most Americans, nothing at all about color filming. But I like out-of-the-way places, new activities, and acquiring additional bits of knowledge. So I fell in with the plan at once.

At first we were puzzled as to how to reach Grassholm. On the map it is a tiny dot about twelve miles from the nearest coast line, and we knew no one lived on it and that it was not a place where we could stay. We would have to make our headquarters elsewhere, probably on the mainland, and find our way to Grassholm by boat.

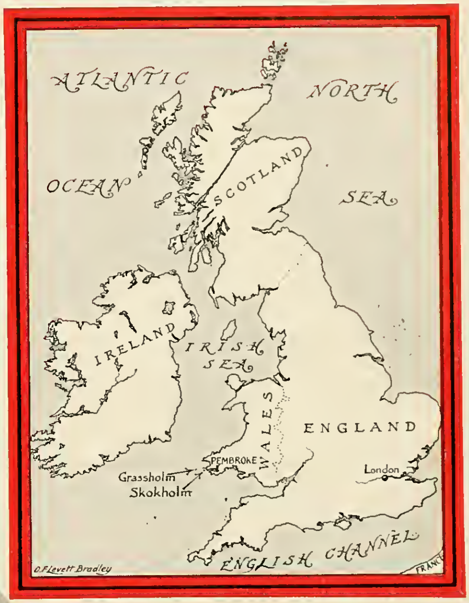
The nearest village we could see on the map was Dale, and accordingly my husband wrote to the vil-

IS AN ISLAND TOO

Unequalled in their love of winged creatures, the English have established many sanctuaries for birds of land and shore. Here is the record of a pre-war visit to one of the offshore islands now disrupted by Nazi bombs

lage clerk there, asking him for information about accommodations, and permission to visit Grassholm. Several days later an answer came, not from the village dignitary, but from R. M. Lockley of Skokholm Island.

We knew nothing of Lockley then but were delighted to find that his bird sanctuary on Skokholm, about six miles from the coast, was open to bird-enthusiasts at a fee of nine shillings a day, including bed and board and a "reasonable amount" of cider. A lobster boat would take us to and from the island for a fee of six shillings. The little booklet in which these details were set forth was obviously designed to discourage all but the most genuine of bird lovers. It pointed out that living conditions on the island were very primitive, that everyone was expected to make his own bed, do his own room; that the men slept in a dormitory separate from the wo-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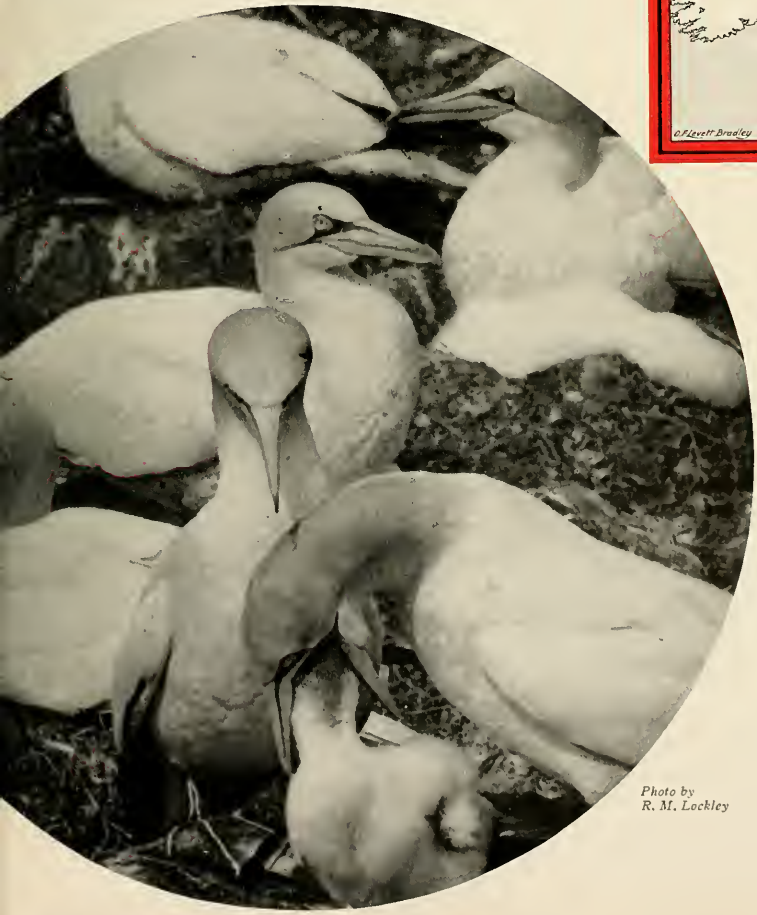

Photo by
R. M. Lockley

(Left) FEEDING by regurgitation *(foreground)* has its drawbacks—for human visitors. The youngsters are often finicky and leave portions of their daily fare exposed to the strong sunlight. Some 40,000 birds occupy this island

men, that the women were expected to help in the kitchen. It was a further condition that visitors to the island were expected to assist in the drives which took place three times a day to round up and band the migratory birds.

"Gosh!" I said to my husband, "I don't believe I ought to go. I don't mind a primitive life or taking my turn in the kitchen, but it's obvious that I don't know anything about birds, and you can see this Lockley person means business. I'm likely to be turned off the island the first day."

"Nonsense," said my husband, "he won't expect both of us to be equally knowledgeable about birds. You need only show a little interest and help me with the filming."

I looked at him. After nine years of marriage to an Englishman I had never quite got used to the role of subordinate. Suddenly this holiday took on a sinister aspect. So I could show a little interest and help with the filming (that meant carrying the rolls of films around and being sworn at when I misplaced one) and thus be tolerated on an island where clearly I was not wanted!

"No," I said, "I'm not going to pretend anything. I'm going to take my typewriter and work on my play, and if you or he doesn't like it, that's too bad. I can't possibly count birds, my eyes are too bad to see anything more than a few yards away, and anyway I don't know one bird from another."

"You can learn," said my husband, quietly and firmly.

The road to adventure

We started for Wales one morning at the end of July. We felt very gay and grand. The day before we had traded in our old car for a second-hand Ford with a very special body with low, raking lines and elegant leather upholstery. We were very proud of this car, and in honor of it I wore a new pale blue tweed suit, a smart sports hat, and lots of nail polish. Even my husband, who prefers gray flannels and old tweed coats had put on his new brown suit, so as not to disgrace our ultra-smart vehicle. Oh yes, we were a sophisticated young couple speeding down the long roads of England into Wales. I giggled when I thought of the primitive island. I'd show this Mr. Lockley!

Pembrokeshire is quite different from the rest of Wales. Indeed, the small part of it around Haverfordwest and Dale is called "little England," and the rest of the country consider the people who live there as foreigners. Dale is a tiny seaside village at the end of what is really a country lane. The Welsh, even in this English corner, are suspicious of strangers, and the landlady of the pub replied firmly to our request for dinner and bed that she had no accommodations and didn't know where we could get any. People around here didn't like taking anyone in for one night, it wasn't profitable.

This reception was a bit discouraging. We sat in the car while dusk fell, debating what to do. We could sleep in the car, but that wasn't an alluring prospect after having spent most of the day in it already. We could make the rounds of the scattered cottages and farms to ask for a bed, but our petrol was low, and there didn't seem to be any way of getting more in the village. We must save enough to get back to Haverfordwest on our return journey. While we were sitting there a man turned into the little square and stood looking at us for a moment. He was of medium height, dark-haired, stocky, clad in brown corduroy shorts and jacket. Presently he came over to us.

"Are you Doctor Bowman?" he asked my husband.

"I am—are you Lockley?"

"Yes." He looked at me rather hostilely, I thought. I was conscious of my new suit and my lipstick.

"Good," said my husband. "This is my wife."

"How do you do." Lockley held out a big, sunburned hand. I shook hands with him. He noticed the red fingernails.

"I'm afraid you'll find the island rather primitive," he said coldly.

"I shan't mind a bit," I said, "I like roughing it."

"Oh!" He was clearly skeptical. I smiled inwardly. It amused me to pose as the sophisticated nitwit before this man of nature. I knew perfectly well my own capabilities, and was looking forward to his "primitive existence." But I was aware that bird lovers, in England at any rate, are not accustomed to use make-up and drive about in rakish cars. I must have been a shock to him, and because of his obvious uncertainty about me, I was prepared to dislike him. I suspected him of being an autocrat on his island.

But where to spend the night?

My husband was explaining our predicament about sleeping quarters.

"You should have asked me to arrange things for you," Lockley said impatiently.

"I didn't like to trouble you," said my husband. "But don't worry about us. We'll manage to find some place."

"I'll ask the schoolmaster to take you in," Lockley said. "He lives up the hill, behind the village."

"No, no—please don't trouble. We'll look for a place."

"I'll ask him," repeated Lockley, "and meet you here in half an hour." He walked away into the gathering darkness. We looked at each other.

"A bit difficult," said my husband.

"He thinks I'm a fast woman, and totally useless," I said, grinning. "Nothing could keep me off that island now."

We got back into the car and started off to make inquiries about the night. But we had no luck. Finally we went into the pub to ask if we could have a meal. The landlady looked bored and reluctant.

"I don't serve dinners," she announced grimly.

"Something cold, perhaps?" I asked timidly.

"We-ell, there's a bit of ham and some tomatoes—"

"I'd like some ham and eggs," said my husband firmly.

"And some tea," I added, taking the cue.

"It will be a few minutes—there's the kettle to set boiling."

"Oh that's all right," we said. "We don't mind waiting!"

In the end we had a meal that was eatable if nothing else, and in the midst of it the landlady suddenly melted and said she could give us a bed, though it would mean that she and her husband would have to move out and sleep elsewhere. We had nearly finished our meal and had made our arrangements with the landlady about our sleeping accommodations when Lockley strode into the room with the news that he had arranged with the schoolmaster for us to sleep there.

Too many reservations

This was bad. We dared not turn down the landlady's offer after she had made such great concessions on our behalf. On the other hand we could see that Lockley was annoyed that we had not waited to consult him. In the end my husband went with him to the schoolmaster's and explained the situation to him. But we were a bit uneasy.

"I don't think I'm going to take to Mr. Lockley," I said, as we undressed, "or he to me."

"He's all right," said my husband, "he's got character. Also he's not quite at ease with us—we don't conform to type."

"He should be able to judge human beings better than that."

"Why?" said my husband, "he's a judge of birds, not of men."

"People shouldn't narrow their interests. The proper study of mankind—"

"Go to sleep," said my husband. "We have to be up at five-thirty to catch the tide."

"Tides," I thought. "Why do they always have to do their work at such an ungodly hour?" But I was glad enough to get up at five and leave our unpleasant bed and stuffy room.

Ready for the primitive life

I dressed this morning in slacks and a dark blouse, but I was deliberately liberal with lipstick and nail polish. Not for any Lockley would I concede that the primitive life excluded beautifying effects. My husband, however, now looked the part, and I could see Lockley was relieved at the sight of the ancient gray flannels and the worn Harris tweed jacket. The morning air was cold, and I donned a sweat shirt and mackintosh before we went down the beach to the boat. Here I was once more in disgrace, for the boat lay several yards out in the water and the only way of reaching it was to wade. Neither of us had brought boots, so my husband took off his shoes and socks, rolled up his trousers, and staggered with me in his arms through the icy water to the boat. Lockley looked disgusted.

The lobster boat stopped at the island daily in the summer months bringing bird enthusiasts, mail and stores, except when the weather was bad. In the latter case all communication with the mainland was cut off for two or three days; once, Lockley told me, ten days. There was no telephone on the island, and an urgent message could only be sent to the mainland with the help of flashes from the lighthouse to the next island, which had a telephone.

The sailors looked askance at me and seemed shy and ill at ease. But after a great deal of sprightly effort on my part I finally got them to talk, though their conversation was not exactly fluent and consisted mostly in identifying the different sea birds that skimmed and plunged round us in the water. As I had packed my spectacles in my bag, this information was lost on me.

After an hour's journey we landed on Skokholm. At first glance the island was not prepossessing. It consisted mostly of bare and treeless moorland, rimmed round with steep red, striated cliffs against which the sea beat unceasingly. The landing place was a miracle wrought by nature out of the rocks of the cliffs; elsewhere there was not a place to land even a rowboat.

It was a lovely sunny day, and the air that blew in from the sea was warm and sweet. Birds darted in and out of the bracken as we made our way to the house; and underfoot the short turf was starred with the lesser celandine, and harebell, and a tiny flame-colored flower. As we approached the house we were met by a small, slender woman and a little girl of six, who were introduced as Mrs. Lockley and Lockley's daughter, Ann. There were also Lockley's pleasant-looking sister and two women dressed in slacks and sweaters, with cropped hair and a masculine outline, —student-assistants. These two, Miss Stark and Miss Webb, were charming, dry-witted women, full of character and energy. They had come to spend a two weeks' holiday as guests on the island, and had liked it so well that they stayed on as student helpers. They were there that year from May to September (the normal season on the island) and went back again the next year.

I do not know why an island fascinates some people so much. Lockley and his wife never felt quite alive on the mainland. I remember asking Mrs. Lockley where they would go for their holiday.

"Oh, we shall go to the Blaskets this year. Ronald is writing a series of articles about islands."

I looked at the little woman with the wistful eyes: "I should think you'd like to go to London and be really gay."

She shuddered. "We don't like London. We feel shut up there. On an island you are free."

Good companions

At the end of the first day Lockley and I were friends. I had not shirked my duties, I had helped beat the bracken for migratory birds, I had washed up the luncheon dishes and shown Mrs. Lockley how to make fresh cottage cheese from goats' milk. I had energetically explored the island with my husband and Lockley and displayed an intelligent interest in the birds.

One evening, when I asked him how he happened to come to the island in the first place, he told me the whole story. He had been a sheep farmer on the mainland when he was a young man, but always in the back of his mind lay the desire to own and live on an island. When he found Skokholm, with its wide sweep of moorland, its untouched wildlife, its soft airs and remoteness, he knew he had found his heart's desire. He leased the abandoned farm, moved his flock of sheep there and began the life of a sheep farmer anew. But now something came to trouble him. He fell in love and wanted to get married. He had no home fit for a bride, for the old farmhouse was in ruins. It would take years to raise money enough to build a house. There was not a stick of timber on the island, and the expense of bringing it from the mainland was prohibitive.

"But I've always been lucky," Lockley said, with a smile. "One night the *Alice Williams* with a cargo of coal was blown ashore and broken to pieces on the cliffs. I bought the salvage rights for five pounds and got enough timber to build the house as you see it now and enough coal for four years. We hauled the coal up the cliff in baskets. It took a long time, but it was worth it."

He built the house with his own hands, and when it was finished he brought his bride to live there. I thought Mrs. Lockley must be a very brave woman indeed. Their little girl, Ann, was born and brought up on the island and knew almost as much about the insects, birds, and flowers as her father.

Presently Lockley began to turn his attention more and more toward the bird life on the island. Sheep farming did not pay, so he began to supplement his tiny income with articles about the birds and other wildlife on Skokholm. He wrote with charm and authority, and soon his income from his writings was sufficient to keep the little ménage going without the aid of the sheep. He sold them, and turned the island into a bird sanctuary. Most bird sanctuaries are financed and controlled by the great ornithological societies or by the Government, but Lockley was master on his island and kept his independence. He is now one of the foremost authorities on the migration of sea birds in the British Isles.

The original farmhouse was now the family headquarters and housed the women guests, while the old farm buildings provided a dormitory for the male guests and a combination kitchen and dining room. The food was delicious. There was always a huge leg of mutton or a great ham, a bowl of newly-dug potatoes boiled in their jackets, a great dish of broad beans or peas from the garden, salad, cheeses, hot scones, sometimes a pudding or fruit and junket, and when the lobster boat came in, a dish of fresh crab or lobster for tea. We ate enormously.

Little Ann looked after the goats, letting them out of the pen in the morning and rounding them up across the width of the island at dusk. She milked them, too, and tried to teach me, but I was slow, and animals always make me nervous. A backward glance from their wicked eyes frightened me, but Ann would shove the offending face away and go on with her milking quite calmly.

Banding

But we had come to study birds. Three times a day, after meals, the whole company was led out to the bracken clumps by Lockley. I used to protest loudly, especially after I had eaten a huge dinner, but Lockley had no mercy on me, although we were now friends.

The beating of the bracken was rather amusing. We all trailed down to the lower end of the clumps and ranged ourselves in a long line with about ten yards between us. We were armed with long sticks,

(Above) GANNETS in flight. Many of the birds are banded

Photos by R. M. Lockley

(Right) THROUGH THE AIRWAYS where these birds wheel in flight, engines of death now speed and man's peace-time conservation efforts must give way to the grim struggle for his own survival

Bowman photos

(Above) A FLEDGLING waiting for a meal. Besides gannets, Skokholm supports puffins, petrels, shearwaters, and various gulls

BIRD STUDENTS find a unique headquarters on near-by Skokholm, six miles offshore. Below, R. M. Lockley, head of the Skokholm sanctuary, lends a hand in the banding of a one-year-old-gannet

and at a given signal we moved toward the trap, slashing at the bracken. The birds flew out of the undergrowth and were gradually driven into the big Heligoland trap. This was a three-sided erection of chicken wire, quite spacious, which at the far end opened into a smaller enclosure. When the birds had been harried into the second trap, a door was shut behind them, and then one or two of us, slipping through the door, drove the birds farther into a small cage about a yard square. When the door of this latter cage had been secured, Lockley went outside. Reaching into the interior through a long woolen sock, he extracted the frightened bird, banded one of its legs with a bit of metal stamped with the date and code number of the island, and let it go. Most of the birds, when we were there, were willow warblers and chiffchaffs. Occasionally we trapped a bird which had been ringed one, two or three years ago. That was exciting, for it meant the bird had visited the island before and was now returning on a migratory flight. These former visitors were always marked down specially in the logbook, since they provided valuable data on migration.

Once or twice (in the intervals between typing, cooking, and washing up) I went with my husband while he tramped the island looking for birds to film. It was easy to distinguish the puffins, those amusing big-beaked sea birds who sit about in orderly colonies like so many pompous old men in their clubs, dressed in dinner jackets and burbling quietly among themselves. Shearwaters and petrels were more difficult, though I finally learned to tell the shearwater by its flight.

The story of the shearwater

The petrel and shearwater lived in burrows in the ground made by the innumerable rabbits that infested the island. Lockley fetched out a couple of baby shearwaters for us to see and photograph. They were fat little balls of gray down, and loathed being brought out into the open, as the sun hurt their eyes after the darkness of their burrows. The story of the shearwater is the most fascinating of all. The chicks are hatched in the burrows about May and are fed through the summer by their hard-working and conscientious parents. They grow so fat that they can scarcely move, but there is wisdom in this. For one day, in the late summer, the parents fly away over the sea to the far south, and the baby chicks must now fend for themselves. For a fortnight or three weeks they wait patiently for the parents to come to feed them, until hunger finally drives them forth to the mouth of the burrow. They are thin now, and a good thing, too, for they could never fly in their former state of helpless obesity. At the mouth of the burrow they sit and rest, and wait for darkness to fall. Even the baby shearwater knows instinctively it must not venture out in daylight, since, owing to the awkwardness of its take-off, it cannot get into the air quickly enough to escape the murderous assault of the black-headed gull who preys upon it. When darkness comes, a true dark, not lighted by the moon, the little shearwater lumbers and half flies to the cliff's edge. It is a long, tiresome, and dangerous journey, and I fear many of them do not reach the sea before they are killed by the predatory gull.

Once at the sea's edge, these little birds, who have never flown, never seen the sea, and who have always had their food brought to them, launch out into the air and in that moment reach maturity, winging their way across the dark waters as adults in search of food. Their childhood is thus ended suddenly, and perhaps cruelly, according to human standards.

A midnight pursuit

The banding of the adult shearwaters was one of the entertainments of the island. It took place after dark, when the birds came home from their day at sea, uttering their wild, eerie shrieks unlike any other sound on earth, literally making your hair stand on end when you first hear them. At about eleven o'clock (for the shearwater will not come to land till daylight is gone) the first harsh cry would break the twilight stillness, and from then till early dawn the air was made hideous by the strange high-pitched cry of the returning shearwaters.

At about midnight when the noise was at its height we donned rubber boots and mackintoshes as a protection against the damp underfoot and the ministrations of the birds as they flew above and around us, and sallied forth into the darkness with torchlight and a pocketful of soft metal rings. The ground was pocked with rabbit burrows, and we stumbled and fell in the darkness, grumbling and laughing as we chased the birds. They were quite dazzled by the torch, and once you picked one up with the light it was easy to catch it, providing you seized it expertly around the body, far enough back so that the long neck with its sharp beak could not injure your hand with a vicious peck. Your partner would then come stumbling toward you, and between you the little ring, which was already entered in Lockley's logbook, would be clamped on.

I neither liked holding the scared and pecking bird nor fastening on the ring, but I found ringing was my job, willy-nilly. I was afraid that the thin struggling leg would break in my grasp, but somehow it never did. It was a weird experience—the pitch-dark night, broken by the flashes of torches, the shrill cries of the birds, the wet hummocky ground underfoot, the glimpses of rain-coated enthusiasts slipping and running in their chase after the birds. When the bird was banded, it was thrust down the nearest burrow, so that no one else would waste time trying to catch it. I wondered what the birds thought as they tumbled down a strange hole and found themselves in someone else's house, with someone else's hungry child.

The ringing went on for two or three hours, and then the party went back to the house, drank cider and ate biscuits, discussed the adventure and fell exhausted into bed to sleep the sleep of the healthily tired.

Sometimes one could corner Lockley in the late afternoon, and sitting in the sun, listen to his tales of other islands, of adventures on Skokholm itself, of birds and insects and their strange ways. I liked him immensely after my first encounter with him and admired his truly vast knowledge of his subject, his direct and uncompromising attitude towards life, and his undeniable charm. I have met few men who impressed me to the same degree.

Goat's hair for bait

At dusk my husband and I would take a couple of primitive fishing poles down to the cliffs and for an hour or two fish the deep waters around the island with a bait of white goat's hair. We never caught more than one fish each, but the pleasure of standing there on the slippery cliff base as the day waned and the mist rose against us far outweighed disappointment in our small catch. But one day a small yacht came into the bay and the owner, who was a friend of Lockley's, asked if anyone on the island would like to troll for mackerel outside the little harbor. My husband and I rushed down to the yacht at once and were given great trolling lines weighted with a two-pound lead. We started off in the motor-driven dinghy, circling round and round the blue waters of the bay. It was a fisherman's dream. I had only to let out my line to its full length to feel a heavy tug, and when I had reeled in, I had a fine three-pound mackerel. In a quarter of an hour I had caught eight of the beauties, and my husband an equal number. We concluded this was enough, in fact the wholesale slaughter became distressing after the first fifteen minutes. We took our haul back to the island, where we feasted next day on mackerel livers fried in butter for breakfast and broiled mackerel for lunch.

The highlight of our expedition was, of course, the visit to Grassholm. We set off one Sunday morning in a calm sea under a scorching sun. There were about a dozen of us—Lockley's five, three locals from the village of Dale (who had foolishly come in their best Sunday blacks for a day's outing and were made by Lockley to help with the banding, to the detriment of their clothes), the crew, and ourselves. It took about an hour to reach Grassholm in the lobster boat. When we scrambled ashore on the lee of the island, it looked like any other deserted place. The grass grew long and thick on the slope, a few gulls wheeled overhead, there was nothing to indicate that this was one of the unique places of the earth.

After disembarking with difficulty in the perilous little bay, we climbed toward a steep ridge, which divides the island sharply.

"What wonderful grass," I said, as I plowed through it to the summit.

"The birds used to be on this side," said Lockley. "You notice how the ground gives under your feet; it is honeycombed with old nests. The guano accounts for the richness of the grass."

I was feeling full of energy and bounded up the last few feet to the top of the ridge.

What met my eyes is really indescribable, compounded as it was of smell, sound, and sight. Owing to some strange arrangement of acoustics and wind currents, not an inkling of what one was to expect came till one stood on the summit. There, on the other side of the ridge lay a white mass of screaming, fluttering, flying birds stretching as far as the eye could see. Lockley says there are at least 40,000 of them.

The noise and the smell were terrific—especially the smell. The gannet feeds its young on regurgitated fish, and much of this was left by temperamental youngsters to decay in the strong sunshine of the eastern slope. Added to the excrement deposited by the 40,000 it created the smell of smells. The noise was augmented by our coming, which caused most of the great adult birds to leave the nests and swoop out toward the safety of the sea, uttering loud squawks of terror and indignation. The beautiful sweeping flight against the deep blue of sea and sky was unforgettable.

My husband, after several misadventures with recalcitrant film, got one reel of color-film of this flight, which is one of the loveliest things of its kind I have ever seen. In the film these great birds look like huge white crosses floating down the blue sky, diminishing in the distance to tiny specks like drifts of snow.

Birds of every stage were under our feet, from the newly-hatched, naked, helpless chick to the magnificent white, yellow-eyed adult with a wingspread of as much as six or eight feet. The ages in between were characterized by different plumage. The young of that year were white and fluffy and had not yet learned to fly and were the easiest to catch for ringing. The second-year chicks were a speckled gray; they flew well and had already been on their first migratory flight to the southern seas. The third-year birds were smooth and white again and very difficult to catch for banding. It took one person to hold each bird and another to do the banding. Nevertheless, our party succeeded in ringing 800 of them before we left the island.

The noise and smell suddenly sickened me, so I bade the others farewell and slipped across the ridge to the other side. There I lay in the luxuriant grass, completely out of sight and sound of the noisy, smelly mass of birds. I lay sleepily looking up into the sky watching the scattered gulls wheel over my head, uttering their muted cries.

It never occurred to me then that in three years' time there would be other birds streaking across the island, birds a thousand times the size of the beautiful gannets, carrying death in their steel bellies. No, it never occurred to me, for on an island one is safe and free from the impingement of a cruel and ill-adjusted humanity. The noise is of birds, not of bombs, the sky is full of wings, instead of steel; the rain that falls is beneficent, bringing life instead of death.

I did not think of death and destruction as I lay waiting on the grassy slope. I only thought how the study and protection of birds is one of the most peaceful, most interesting occupations. I resolved to come back again to Skokholm, to become a serious student of bird life, to learn a few salutary lessons from bird ways, to deepen my friendship with Lockley and others of his kind. White birds against a blue sea, and down below on the rocks some mother seals crooning their absurd babies to sleep.

But I never went back, and now the bombers make their way most days across the islands of Grassholm and Skokholm and the sea birds have been ousted from the sky by the giant birds of death. And yet—and yet—I think I *will* go back again, for the birds will return, and the islands remain, long after the bombers have crashed for the last time.

England is an island too.

(Below) SHEARWATERS feeding. These birds live in the rabbit burrows that honeycomb Skokholm. Parents feed their chicks for a time, then abandon them. The latter, then on their own and a ready prey to the black-headed gull, instinctively come into the open only at night. Once at the sea's edge, the little birds who have never flown nor seen the sea, launch into flight and become adults.

Photo by R. M. Lockley

Mud, Stones, and History

The rise of N. C. Nelson from Danish farm boy to one of America's outstanding chroniclers of the life and times of prehistoric man

By D. R. Barton

In reviewing the career of Nels Christian Nelson, who has revealed so much of Man's past, one cannot easily avoid a feeling of special significance for the present highly critical hour in the world's history. His 35 years of unobtrusive scholarly achievement bear valuable testimony in refutation of the doctrine that stamina and intellectual leadership are the non-negotiable property of any one class or nation, and certainly his notable contributions to science may be numbered among the rewarding fruits of a free democracy.

His is, indeed, the familiar American success story of innate talent which secured opportunity for self-fulfillment within a fluid and incompletely stratified society and which made the most of that opportunity despite the towering barriers of language and poverty.

He was born not far from the site of the Battle of Jutland in a straw-thatched Danish farmhouse. Attending school during seasonal furloughs from his chores, he received an education sufficient at least to read admiringly of his immortal namesake, Nelson of Trafalgar and also to allow rapt absorption of J. Fenimore Cooper's novels. The latter stimulated a fondness for Indians which has not cooled to this day and which led him to dream often of coming to America where some of his relatives had already immigrated. This dream became a reality when in May of 1892 an aunt, living in Minnesota, sent him a steerage ticket to New York.

Half expecting to be greeted at the dock by the warwhoops of Indian savages, he became an obscure particle of the huge Atlantic Migration which had been furnishing new traits, skills, and attitudes to a burgeoning civilization for a hundred years and more. His horizons had lifted, and so determined was he to start life afresh that on sailing through the Narrows, he flung his old clothes out the porthole and faced Ellis Island inquisitors stripped of all that decency and prudence permitted.

When he had gone on to Minnesota, however, he found the daily round of the Danish colony little different from the regime he had left behind. On his uncle's farm he worked hard at the same old chores to pay off the expenses of his journey, but he soon perceived that if he were ever to become truly Americanized he would have to forsake the transplanted way of the homeland. Accordingly, he hired himself out to a farmer near the town of Marshall, Minnesota, where in five and one-half years he completed grammar and high school, finally graduating in the spring of 1901.

Kaiden-Kazanjian Photo

N. C. Nelson

To work one's way through school is difficult enough at best, but for young Nels it was a double triumph. At the age of seventeen he had to stand in the country schoolroom near his uncle's farm, spelling out c-a-t in the company of knee-high tots who had long since learned the spoken language. Possibly the need to overcome such handicaps opened up unsuspected reservoirs of energy. At any rate, he acquired a considerable reputation for scholarship and his friends and benefactors were anxious that he take up the traditional profession of a man of learning—the ministry.

It seems worth recalling at this point that Mr. Nelson's present colleague, Dr. William K. Gregory* was launched on his scholarly career with a similar end in view. And it is of passing interest that both fell in with the idea amicably enough at first.

A brace of pretty daughters in the home of his employer had enticed the youthful Nels to spend a good deal of his time around the church, which was the center of social life. But midway through high school he struck a snag. Physics, chemistry, and botany were included in the curriculum and it was here, as he says, that "the trouble started."

His Latin teacher, who also taught botany, accused him of jilting irregular verbs for stamens and pistils, and as time went on his inclinations drew him farther away from the classics. Then, too, various scientific concepts encountered in the laboratory seemed to contradict standard theological explanations of the universe and this conflict, which troubled his soul no little, he was determined to resolve in college.

According to the schedule friends had laid out for him, his higher education was to be pursued in a nearby denominational college. But at this time a family of Californians, sojourning in Minnesota for health reasons, were about to return to their native state. They sang the praises of the latter as only Californians can, and persuaded Nels to go along. The nine-day trip was made in a freight car filled with farming implements, household goods, and a variety of livestock. Transportation was free in exchange for Nels's services as stock tender.

Philosophy

The problem of acquiring the wherewithal for his higher education was with him late and soon. But in

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* See "The Evolution of an Evolutionist," by D. R. Barton, Natural History, April, 1941, p. 234.

California's expanding economy of that era, plenty of jobs were to be had if one were not too particular in the choosing. After driving a six-mule team for a while, Nels joined a hog-butchering crew, taking special charge of the lard-rendering process. He stuck to this bloody business until he had accumulated sufficient funds to enroll in Stanford University, whose sages he then called upon to set at rest his inner doubts.

The leap from butcher's block to philosopher's stone was negotiated nimbly enough, but he had not penetrated very far into the wisdom of the ages when Stanford's only professor of philosophy accepted a chair at the University of California in Berkeley. Left with the choice of discontinuing his quest for the meaning of meaning or following suit, Nelson decided to transfer his allegiance also. At Berkeley he plunged even more deeply into cosmic mysteries, only to be confronted by such abstruse concepts as Kant's Doctrine of the Transcendental Ego of Apperception. His professor was sympathetic but not particularly helpful. He himself had read Kant 26 times without being able to achieve anything beyond a frank bewilderment.

It was not long before Nels began to realize that he was getting nowhere rapidly. Better men than he, it appeared, had been wrestling with the problem of the universe with very little in the way of successful solution, and he decided that the best way out of his conflict was simply to ignore it.

More or less out of a sense of obligation, he took courses at the Unitarian seminary, but he abandoned all notion of going into church work from the moment he was bitten by the anthropology virus.

Quite by accident, in 1906, he accompanied a friend on an archaeological expedition to dig up an old Indian cemetery, near Ukiah, some distance north of San Francisco Bay. Immediately thereafter he signed up for all available courses in anthropology, feeling that at last he had found his metier.

Sudden though this conversion seems at first blush, it probably derived its lasting effect from an inherent susceptibility. For almost a decade earlier he had been tremendously impressed by a graphic historical display of Man's tools arranged in chronological order, which he chanced to visit at the Omaha Exposition of 1898. In the same building a collection of Indian artifacts was also on exhibition—as mere curiosities it is true, but for all that no whit less stimulating to a boy who had grown up in the fanciful company of Leatherstocking and Chingachgook. Had the science of archaeology been at all publicized in the Middle West of that day, it is quite likely that Nelson would have hitched his wagon to its star then and there. But though his imagination had been profoundly affected, the notion that a man could live by studying the evolution and distribution of potsherds, arrowheads, and axes simply did not occur to him. Nevertheless the idea had been planted in the back of his mind and when he delved into his first shell mound on the shore of San Francisco Bay, the seed burst into full flower.

Here, it seemed, was more substantial food for thought. Archaeology had about it no stale odor of the recluse, no abstract will-o'-the-wisps of otherworldly minds. It was most emphatically of this earth, and most emphatically material. Mud and stones. The one molded and baked to form a food pot, the other chipped and sharpened into a deadly weapon — the winged bomb of its day — with which to keep that pot always filled. This was archaeology. By carefully studying a handful of flint spearheads and a few scraps of pottery, one might push back the horizons of history. And how it broadened one's vision! All Man's inventions were but links in a seemingly endless chain, and the creation of a pointed stick for digging up roots was relatively quite as marvelous, quite as important to Man's destiny as the airplane or the radio.

Equal portions of field work and laboratory study prepared him finally for work in the Museum of Anthropology conducted by the school at Berkeley, where he became an Assistant Curator after his graduation. His master's thesis took the shape of a report on an archaeological survey of the entire San Francisco, San Pablo and Suisun Bay shore, over which territory he walked more than 3000 miles, according to his pedometer, and located about 400 shell mounds.

All this time, Nelson was still earning his way in true Alger fashion. He had been getting up at five every morning to punch the clock in a local bank where he served as a sort of combined janitor and office boy, doing everything from dusting the president's desk to picking up the money that was left scattered around the tellers' booths after a busy day. He admits that this apparent carelessness may have been calculated to test his honesty. Suffice it to say he never tried to find out.

One morning his alarm clock went off at five as usual, and he was about to dress when quite to his astonishment the bookcase on the opposite side of the room fell over and with a thundering crash slid under his bed. To his further astonishment, the room then proceeded to rock like a ship in a storm, the walls cracked and the plaster fell about his ears. Sizing up the situation as hopeless, he decided that struggling young archaeologists as well as generals could enjoy the ultimate luxury of dying in bed. Nothing further happened, however, and he dug himself out of the debris, dressed, and went out to join the excited crowds on the street.

He was, of course, in the midst of the celebrated San Francisco earthquake of 1906, and distinctly worried about the safety of a girl friend who was teaching in San Francisco. A mutual, influential friend obtained for him a pass signed by the governor, himself, enabling him to cross the Bay. To obtain it, however, he stretched a point, claiming that Nelson was going to rescue his wife. On the third day of the fire the lady and some of her valuables were safely landed in Berkeley.

Museum curatorship

Some of Nelson's studies were carried out under the direction of Doctor Pliny E. Goddard, a noted anthropologist on the coast, and subsequent American Museum curator, who shared with Nelson and Gregory the "original sin" of having started out destined for the ministry. Indeed, Goddard was once a missionary to the Indians. But the latter were evidently possessed of much more persuasive tongues, for he ended up as an enraptured student of their languages.

Goddard was so impressed by Nelson's ability that he made an effort to bring him east soon after his own appointment to the Staff of the American Museum. His erstwhile protégé was, however, quite happy on the coast, and did not yield until a promise of major archaeological expeditions to new fields in the Southwest proved too much for his powers of resistance. Accordingly, Nelson packed up bag and baggage and came to New York in 1912 as Assistant Curator of Prehistoric Archaeology, convinced that the opportunity for the concentrated work he so desired was now at hand.

This turned out to be true enough. But he was enjoined to concentrate on a project far removed from what he had anticipated. For at this time, Professor Osborn, versatile President of the Museum, had developed a passionate interest in European archaeology and was determined that this field should be worked over at firsthand by a competent representative.

However competent he may have been, Nelson was at this time anything but an authority on Old World archaeology. But, orders being orders, he made up his mind that if he was not going to see America first he might as well bone up on the European literature and devote himself to investigations on foreign soil. Presently he was taking part in extensive excavations in the Castillo cave in Spain and visiting famous archaeologists in all the countries of western Europe, including his native Denmark.

To China and back

During the years that followed, he made several more extended European trips, visiting all the important museums and many famous archaeological sites. The work in the American Southwest went on in the meantime—with conspicuous results to be treated in detail later. Thereafter he grovelled in the murk of Kentucky and Missouri caves, and even sampled the shell mounds of Florida, for which heretical act his California friends may never forgive him.

Then in 1925, Nelson ventured upon a new continent—Asia—while serving as archaeologist for the Central Asiatic Expedition under the leadership of Roy Chapman Andrews.

He had been out in the Gobi only a few days with the main caravan when he came across his first find in this unexplored region. Here at last Nelson could satisfy his itch to sink a shovel in absolutely new territory. But the Central Asiatic Expedition had so rapid a production schedule that no one was allowed to tarry very long in one place.* And neither time nor equipment was available to apply the rather ponderous if thoroughgoing method of stratigraphic excavation to the Gobi.

It was during this trip that Nelson was first confronted with serious danger—the price one often has to pay for being the first to explore new vistas. Various members of the expedition, to replenish the camp fare, regularly hunted antelope wherever available and thereby aroused the hostility of the Mongols, who were anxious for any excuse to strong-arm the intruders. When these formidable-looking roughriders came roaring down out of the desert hills, Nelson arrayed himself with the other members of the party in a tightly drawn knot which bristled with repeating rifles. The muzzles of these pieces evidently looked a little too minatory, for the lords of the desert calmed down quickly enough and even stayed for supper. On another occasion, Nelson completely overawed the always truculent Mongols by pretending to be a magician, able to remove his (artificial) eye and put it back again.

Like his paleontological colleague, Walter Granger, Nelson left the Gobi in winter for milder, if no less belligerent, climes along the Yangtze river and like him also ran a gamut of rifle fire from the skirmishers along the banks. He had come to these famous Yangtze Gorges for the purpose of examining the numerous caves situated in both cliff walls, a project which, though archaeologically almost fruitless, marks one of the most romantic episodes in his life.

Accompanied by Mrs. Nelson, he sailed upstream some 400 miles on a picturesque, high-poop-decked Chinese junk, complete with captain, crew, and servants—in all, 22 people. As Nelson trod the "quarter-deck" in the role of supreme commander, his mind harked back to the famous historical figure for whom he was nicknamed in high school days. Bonaparte's fleet might be lurking nearby, and in that bellicose atmosphere, Trafalgar Bay could well lie around the next bend of the river.

In any event, the "Admiral" expected that every Chinaman would do his duty. Nor was he disappointed, for the crew deeply appreciated the security of sailing under the American flag. As with Granger's coolies, they lived in constant dread of being shanghaied for transport purposes by sundry local militia. Indeed their boat was robbed and most of the sailors taken prisoners the moment the Nelsons departed. But no mishap of major importance occurred on the trip itself, and Nelson was able to land whenever he chose to examine caves or survey small tributary valleys—all the while trying to put himself in the position

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* See "The Way of a Fossil Hunter," by D. R. Barton, NATURAL HISTORY, March, 1941, p. 172.

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of a Stone Age man on a house-hunting foray. That was the first step in selecting a cave for study purposes. If it struck his own fancy as prospective shelter, he felt it was worth-while climbing up the steep bank to peer inside. Then if there was any soil at the mouth of or in the interior of the cave he would proceed to dig for whatever Dame Fortune might yield.

The good lady, though not as bountiful as she might have been, gave up a considerable assemblage of artifacts in the Gobi as well as along the river banks. After fully two months of river sailing, the Nelsons joined the Grangers at winter headquarters in the temple of the T'an family, above the treaty port of Wanhsien, where paleontologist and archaeologist joined forces to inspect the neighboring fossil quarries. To get out of the war-torn interior all were obliged to sail down the Yangtze to Shanghai; but the next winter they explored the banks of the Yangtze again, some 800 miles further upstream in Yunnan Province.

Contributions

Such, in bare outline, is the record of Mr. Nelson's wanderings in quest of the raw materials of his science. But if we are to gain some idea of what he has done with this material, what in short have been his contributions to archaeology, it will be necessary to say a word about the state of that branch of science at the time when he first entered its lists.

Nearly all the sciences founded upon the collection and serial study of physical objects began as hobbies, and archaeology is no exception. Dignified by the name of "antiquarianism," it contributed odd collections picked up here and there, which were preserved as engaging curios. Indeed, the chief distinction between the antiquarian and the archaeologist lies in the organization of materials. The latter goes beyond simple curiosity in an effort to interpret his collections and to arrange them in their natural order, so that new chapters in the vast unwritten history of our race may come to light.

Few people realize the relative novelty of this approach. Before Columbus, artifacts were regarded as not merely curious but supernatural. They had, it seemed, been deposited on the earth for some divine reason or other but had little to do with Man himself, in a material sense. Then gradually as more and more travelers began to encounter the red man in America, the brown man in Polynesia, and the black man in Africa, European culture was confronted with its primitive self in the flesh. Here was the Stone Age in actual operation. It became increasingly evident that European Man had himself once been a savage, and in the acknowledgment of this fact lay the germ of a new science.

But prehistoric archaeology itself did not blossom out of the antiquarian soil until the development of the stratigraphic method of excavation—which, at its simplest, operates on the theory that artifacts are deposited in definite layers of gradational antiquity, the oldest stage of a given culture being represented by that layer which lies deepest below the surface.

Nelson has the distinction of being the first to apply this principle to excavations on the American continents. But accident, it must be admitted, played a part in this attainment.

Some years before Nelson investigated the pueblo area of the Southwest, a competent American Museum archaeologist, George Pepper by name, was sent out for the specific purpose of ascertaining whether or not the stratigraphic method would work in this particular region. Most acute observers expected it would. But when Pepper chose a site and began to dig, he found such a confusion of early and recent objects at all levels that he felt compelled to turn in a disappointing verdict. This report set back archaeological investigation for some years. Still, Doctor Wissler, Curator of Anthropology,* was not satisfied. He felt certain that stratigraphy must work in the New World as well as the Old. Accordingly, he sent Nelson out to investigate the matter and a few months later the mystery was solved. A group of recent Indians had moved Pepper's site, and, unknown to him, disturbed it to such a degree that it was spoiled for archaeological purposes. Nelson then chose a different site in the same locality and found that the stratigraphic method worked perfectly.

From the moment Nelson reversed Pepper's decision, so to speak, Southwestern archaeology began in earnest. But his most important contribution had yet to be made. Paleontologists had been noticing for some time the tendency of their material to lie diffused outward from an apparent center of origin. Later on, Doctor Wissler and other ethnologists had proposed the idea that the Indian horse culture had also diffused from a central point in a configuration which is perhaps best imagined by throwing a pebble into a smooth body of water. The resulting concentric circles of ripples flowing outward illustrate what is apparently the natural course of the geographic dispersion of any human culture.

It was left for archaeology to put this hypothesis to the acid test, and the Southwest was the ideal place to do it. For here a wealth of prehistoric pottery lay buried, and of all archaeological materials pottery is the most sensitive to change.

Human fancy has ever been so fickle that pottery styles differentiated almost as rapidly as the design of female headgear in our own day. Thus even in prehistoric times every culture worthy of the name had its "capital of fashion" and one could always tell a provincial by the fact that he was using last year's pot. Moreover, Nelson was able to show that the further one journeyed into the surrounding "provinces," the more out-of-date the pottery style became. And the pottery was a reliable index of the general scale of living.

His method was simple. Wherever excavations penetrated deep enough to indicate that a ceramic "capital" had once stood on that particular spot, Nelson obtained sample fragments from each stratum, thus charting the *vertical* evolution of styles. Then shallow diggings were made at various distances away from the capital in several directions. These revealed a *horizontal* evolution of the same styles which corresponded remarkably with the vertical gradation. The procedure could be repeated at increasing distances away from the capital until the potsherds bore resemblance to only the most primitive relics found at the center. Here then, the outward spread of the culture by trade, conquest and other agencies might be assumed to have ended. This Age and Area hypothesis, as it is called, is simply another way of saying that the oldest inventions have spread the farthest, and that even if out on the margins some of the old primitive inventions still survive in use, in the center of origin they are deeply buried, as it were, below later inventions.

Once Nelson verified this working principle of Age and Area, anthropologists recognized that it applied not only to particular cultures but to hemispheres as well.

Continued on page 303

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* See "Biographer of the Indian," by D. R. Barton, NATURAL HISTORY, April, 1940, p. 246.

INFORMATION TEST

A few informational high spots that may be gleaned from this month's NATURAL HISTORY

1. What bird "flies" under water but not in the air?

2. The Texas longhorn was
- (a) A breed of cattle
- (b) A saddle used by cowboys
- (c) A mock trombone used by Sam Houston

3. Breaking off the fangs of poisonous serpents renders them permanently harmless.

True........ False........

4. What tree gives material for houses, clothing, cordage, mats, fish nets, food, drink, and soap?

5. What is the so-called "garden" in an emerald?

6. In the lack of sun glasses why would gladitorial contests have appeared green to Nero?

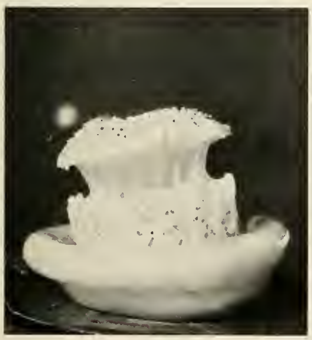
7. Is there any authentic record of a bird literally kicking a snake to death?

8. *Tiphia vernalis* is a
- (a) Most dreaded type of typhoid fever
- (b) An exterminator of Japanese beetles
- (c) Green mold that attacks hibernating bears

9. An octopus has
- (a) One eye
- (b) Two eyes
- (c) No eyes

10. Is the object *(below)*
- (a) A rare mushroom
- (b) A drop of milk photographed with high-speed camera
- (c) A living animal
- (d) A part of a flower

WHAT IS IT? An unusual photograph taken by Anthony V. Ragusin. (For explanation see Answer to Question 10.)



ANSWERS

ANSWERS TO QUESTIONS

1. The penguin. See page 298
2. (a) A breed of cattle, now virtually extinct. See page 300
3. False. Unless the embryo fangs are taken out the defanging is not permanent. See page 283
4. The coconut tree. See page 254
5. The "garden" in an emerald is an aggregation of cracks and flaws, apparently the result of internal strain. See page 275
6. Because Nero viewed the contests through an emerald, in the belief that it would relieve eye strain. See page 275
7. Yes, it is the habit of the secretary bird to kill its prey by vigorous kicking. See page 265
8. (b) An exterminator of Japanese beetles. *Tiphia vernalis*, a digger wasp, is a strong ally in combatting this common pest. See page 268
9. (b) Two eyes. See page 258
10. The object in the photograph is a living animal and is a foot in diameter. It proves that curious creatures which are rarely seen by the average person inhabit the sea in great abundance, for this "cup fish" often occurs in vast swarms, occupying an area that is sometimes over 100 miles in length. It belongs to the jellyfish family and is scientifically known as *Stomolophus meleagris*. In the photograph it is actually upside down, so that you now view it in a more nearly normal position, though the body is somewhat compressed by its own weight. It floats near the surface of the sea and may be found anywhere off our southeastern coast from Chesapeake Bay to Mexico and beyond.

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in the Atlantic

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EUROPEAN NEWTS

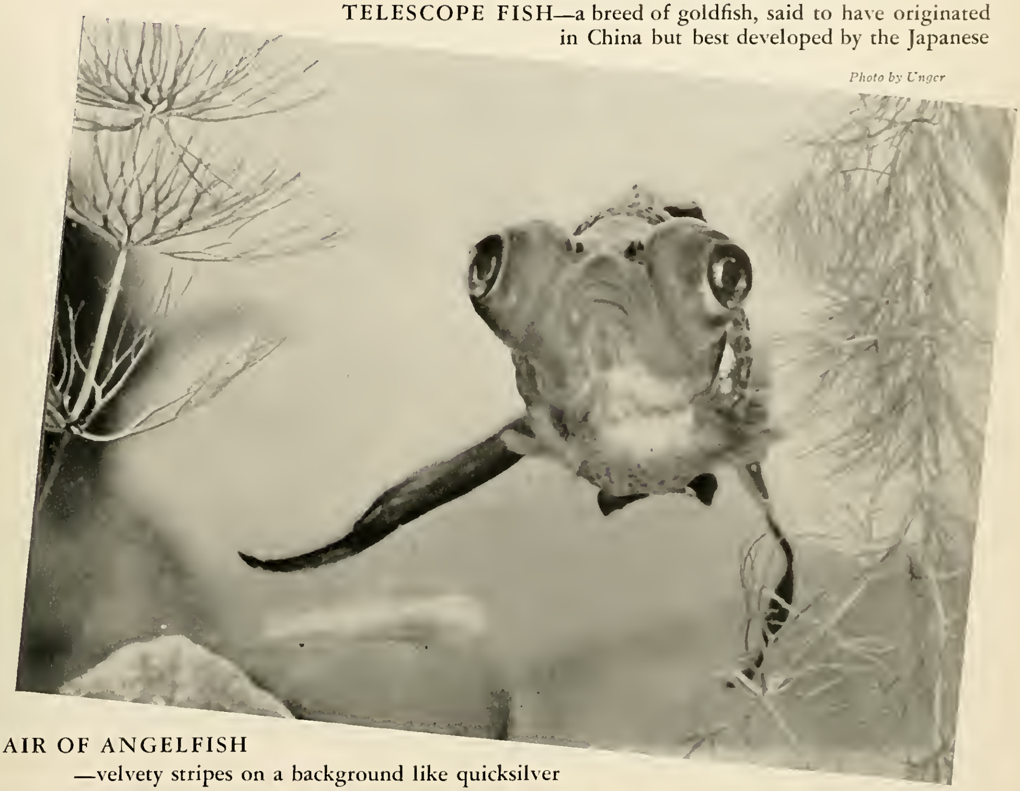
PENGUIN AND FISH
—a remarkable photograph
of a bird that "flies" underwater but not in the air

Photo by Bird

Nature *through* THE CAMERA'S EYE

TELESCOPE FISH—a breed of goldfish, said to have originated in China but best developed by the Japanese

Photo by Unger



A PAIR OF ANGELFISH
—velvety stripes on a background like quicksilver

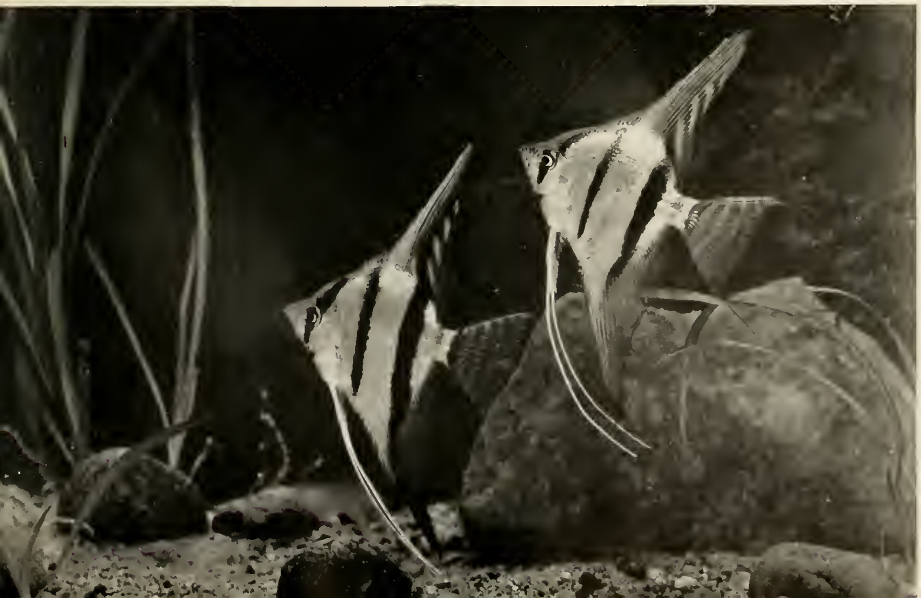


Photo by Unger

YOUR NEW BOOKS

THE HISTORY OF MEDICINE ● AN ADVENTURE ANTHOLOGY
LONGHORNS OF TEXAS ● KABLOONA ● STORY OF THE EARTH
WOLF CHILD ● MAINE BIRDS ● GOLD RUSHES ● FRANK BUCK

MEDICINE AND HUMAN WELFARE

by Henry E. Sigerist

Yale University Press, $2.50

AMONG primitive people and in the civilizations of antiquity, disease and illness represented the expression of evil and hostile spirits. Since spiritual and magic forces were responsible for man's physical woes, it was held to be the function of religion to combat and hold in check these malevolent elements. From this beginning, our modern medicine has gradually evolved. The Greeks were the first to recognize the natural causes of ill health and disease; the Romans began the system of state-encouragement and state-control of the physician; Christianity brought to medicine the ideal of service to all, regardless of position or wealth. The modern period with its emphasis on science and its industrial-capitalist society has created a scientific and competitive medicine. But medicine, as we know it, has not yet achieved its final evolution. Already the signs are evident that medicine is entering upon a phase of greater integration with the social structure. The highly complex, modern community has developed needs which are eventually bound to affect medicine.

To make clear this recent trend, Professor Sigerist has devoted these Terry Lectures to the analysis of the history of medicine. He has traced the movement by reviewing three of its aspects: illness, health, and the physician—describing the changing attitude toward each from antiquity to the present. Professor Sigerist, therefore, gives us the past of medicine to adumbrate its future. The book is authoritative, succinct and of wide interest.

H. L. SHAPIRO.

BIRD ISLANDS DOWN EAST

by Helen Gere Cruickshank

Macmillan, $2.50

IN this account of the little oceanic islands lying off the coast of Maine, Mrs. Cruickshank has combined exciting personal adventure with good, solid natural history information. These islands, steeped in folklore, are in some cases practically isolated from civilization except for a stoic old keeper and an ancient lighthouse, or they may be completely deserted in a shroud of mist and spray. Some are far at sea, others are close inshore, but all are romantic and interesting because of the bird inhabitants which find their last safe refuge from man amongst their scraggly cliffs and in their gnarled old trees.

In company with her husband, the author has spent many summers visiting these little-known dots in the sea in order to study and photograph the sea birds which breed upon them. Her descriptions are so vivid and picturesque that a strong desire to see these things is kindled in the reader —one contemplates the coming vacation. To those who have never taken a particular interest in birds, this book will reveal a sparkling new field both in adventure and in science. The 50 photographs are on a par with the text. They were selected from among the hundreds of pictures which Mr. Cruickshank, one of the country's leading bird photographers, has taken.

This book will appeal to all who know the New England seacoast and who love the sight of "the great cliffs and boiling surf that crashes against the rocks in an unbroken sweep from Portugal." It will appeal to the bird enthusiast because of its fine descriptions of the breeding habits of puffins, cormorants, petrels, ospreys, arctic terns, great blue herons, herring and laughing gulls, and other birds. It contains much interesting information on the migration, banding and conservation of sea birds by the Audubon Society. Quaint superstitions, odd-named islets, historical background, all are expertly woven into the story of these sea birds and of the Todd Wild Life Sanctuary at Hog Island where the Audubon Society maintains an ideal summer camp for bird students. Indeed the reader, in company with the author and her husband, will find the coast coming to life as "the days inexorably pass and each beloved facet of the many-sided Maine Islands takes on a new and poignant appeal."

E. T. G.

THE LONGHORNS

by J. Frank Dobie

Little, Brown, $3.50

THE Texas longhorn is an interesting animal with a romantic history. The great expanse of horn, with its bold, purposeful pattern, has always intrigued the beholder as a marvelous example of maximum development. The history of the breed is closely interwoven with the conquest and growth of the Southwest. Texas today owes much to this hardy strain of pioneer cattle, but the longhorn itself has virtually disappeared from the scene and is a museum rarity. Dobie knows his Southwest, he writes well, and his sympathy with his subject is evidenced by the vast amount of detail he has brought forth from many sources. Anyone who reads this book will get a very good cross-section of the western memoirs which grew up about cattle.

One of the greatest contributions of a book of this sort is the placing upon record of data likely to be lost with the passing of a generation. The old-timers knew at firsthand a great many things that the passage of time has removed from common knowledge. Their descendants can learn of them only as some historian searches out the hearsay and winnows the wheat from the chaff. This is not a book to be read at a sitting. It has plenty of highlights, action and anecdotes, but in between them are historical passages, and the animal is not a mere excuse upon which to hang a framework of episodes. The lawlessness and violence of the Southwest are logically associated with the longhorn, but these are only side issues. The settlement of the territory, the growth of the great herds of cattle, the impress of the longhorn upon the people themselves, all of these are mass developments which overshadow outlaws and gun-men.

The illustrations, by Tom Lea, are excellent. They feature the graphic possibilities of such a dynamic subject without undue exaggeration.

H. E. ANTHONY.

KABLOONA

by Gontran de Poncins

Reynal & Hitchcock, $3.00

I CANNOT regard this book objectively, for it happens that I have seen much of the country it tells about and am personally acquainted with a number of its principal characters, both white and Eskimo. I have read it with keen critical interest, admiring its high literary quality throughout.

Unfortunately, it contains too many exaggerations, half-truths, and misleading statements to be taken seriously for its Arctic lore. It can be properly enjoyed only as a study of a cultured and romantic Frenchman's reaction to, and interpretation of, life among primitive Canadian Eskimos.

Count Gontran de Poncins arrived at what he poetically calls the Glacial Sea with a determination to live the Eskimo life and understand the Eskimo mind; and he at once assumed that the white traders, trappers, missionaries, and Royal Canadian Mounted Police he met there were lacking in the ability or inclination to do likewise. He came "to penetrate into a world to which they were indifferent."

Practically ignoring the scores of explorers, traders, and Mounted Policemen who have examined King William Island and Boothia Peninsula since the middle of the nineteenth century, he fancied himself as very nearly the first white man to hobnob with most of the Eskimos of that area.

Some of his best introspective and analytical writing covers his relations with the manager of the Hudson's Bay Company trading post at King William Island (albeit in doubtful taste) and the ascetic priest in an ice-house at Pelly Bay. But his descriptions of Eskimo folkways, although fascinating, are often shockingly distorted. Indeed, it is only the author's personality that emerges in true perspective.

RICHARD FINNIE.

HIGHROAD TO ADVENTURE

------ Edited by Earl P. Hanson

McBride, $3.00

IN his Introduction, the Editor maintains that to be good an anthology must have direction and point of view. He considers that the greatest adventures occur in the pursuit of some serious objective and represent a spiritual triumph in the face of material defeat. The material he has selected for this adventure anthology holds very closely to his definition of adventure and is wisely edited. The stories have been drawn from the writings of 22 other authors, among them such well-known names as Churchill, Stefansson, Lindbergh, Courtauld, Holdridge, Sheean, and Dana.

Geographically, Mr. Hanson has succeeded in covering the world from the Arctic to the Antarctic, including all the continents; while the stories are distributed over the period from the sixteenth century to the present, with most of them dated after 1900. Four of them deal with aviation, five with the sea, six with wars, and the rest include exploration, mountain climbing, engineering, and hunting.

It is a thrilling collection, and we are indebted to Mr. Hanson for making so much that is worth-while available in one volume.

JUNIUS BIRD.

THE GOLD RUSHES

-------- by W. P. Morrell

Macmillan, $3.00

IN the belief that there is more to history than battles and kings, the publishers have instituted a series of works, known as "The Pioneer Histories," which discuss the expansion of European enterprise. Each recounts the history of some important movement. In the present volume we find an account of the search for gold and the new settlements which accompanied each new find.

After a brief summary of the ancient conquests of golden treasuries, we find descriptions of the gold discoveries in Brazil, Siberia, California, British Columbia, the Rocky Mountain States, Australia, Africa and Alaska. Here are interesting anecdotes which spice the administrative and legal aspects of the exploitation. The consistency of man through many lands and many years makes similar patterns at Beresovsk and Ballarat,—always to many the gold was a scourge, not a boon. Falling yields made governmental taxes equally unbearable in Brazil and Bendigo, and the hardy miners were ever quick to protest. But after the rushes and after the fights, when quiet ruled the land, many territories were better off, with more inhabitants, more improvements and fewer hazards, prepared for further, normal growth.

The book is well illustrated with numerous, attractive outline maps. Although fundamentally about gold; silver, copper and diamonds find a place. So intertwined are our natural resources that few may be considered alone. The South African gold rush followed diamond discoveries which had already created scenes similar in all but the actual loot; there as elsewhere, rush, boom, inflation and panic were again the old familiar sequence.

The bibliography at the close of each chapter, with the author's comments upon the cited works shows how authoritative each discussion really is, and nowhere will there be found such a wealth of information and such thought-provoking suggestions of the influence of the gold rushes upon modern empires and modern struggles for wealth and power.

F. H. POUGH.

WOLF CHILD AND HUMAN CHILD

-------- by Arnold Gesell

Harper, $2.00

THIS vivid little book is an interpretation by a noted specialist in problems of human growth, of the diary of missionaries who found and re-educated an Indian child who had spent most of the first nine years of her life among wolves. The author describes the "wolf" habits which the child had learned: to prefer the dark and shun the light, to run on hands and knees or hands and feet, to tear food and explore with her mouth, and to utter a strange wolf cry at stated periods during the night. Kamala and a younger child, who had also been stolen and reared by wolves were brought up in a missionary orphanage, where they gradually learned human ways. The missionary's wife was a trained masseuse and her skilled hands played a significant role in re-educating the body of this child, who had learned in her flexible infancy to behave like a wolf instead of a human being. The old habits died very slowly. For the first two years, Kamala would sit all day with her back to the other children; at night she roamed about. She refused clothing and would not take food from human hands. When she died at seventeen, she had learned to walk upright, although she never learned to walk gracefully or to run. She wore clothes, performed simple tasks about the orphanage, cared for the babies and spoke in simple sentences.

The well-authenticated story is an impressive illustration of man's almost incredible power of learning. This human child had managed to learn wolf ways, to which her body was not naturally adapted; torn from her wolf home, she later learned

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human ways, slowly, painfully, but in the same orderly sequence as she might have learned them as an infant. Professor Gesell has handled the story with a romantic appreciation of its tremendous implications for the science of man.

MARGARET MEAD.

SEX AND RACE

- - - - - - - - - by J. A. Rogers

J. A. Rogers Publications, N. Y., $3.00

THE miscegenation of the Negroes with various other groups of mankind is an ancient and widespread phenomenon but we shall never know its exact extent. There are some who prefer to stress the contribution of Negro blood to that of various non-Negro stocks. Others seek to minimize both the degree of Negro admixture and its genetic significance. But to the historian and to the scientist the evidence is indubitable that such admixtures have taken place, varying in amount according to place and time.

Mr. Rogers has essayed in this volume, dealing with Negro miscegenation only in the Old World, to indicate the scope of the phenomenon. Since the process of mixture is undeniable and its evidence accessible, it is unfortunate that the author has been uncritical both in his choice of authorities and in examples. Interpretations of considerable license and discredited writers of no standing jostle unimpeachable witness. Such indiscriminate use of evidence can only injure the measure of truth which exists in the author's thesis. By strict adherence to the soundest criteria, Mr. Rogers might have proved much by demonstrating little. He has, in fact, weakened the little by claiming too much.

H. L. S.

WHEN THE WORLD WAS YOUNG

- - - - by Martha McBride Morrel

Houghton Mifflin, $3.00

IN a Foreword to this book, Professor L. C. Glenn of Vanderbilt University says, "In the field of geology I know of no book by a technically trained geologist that succeeds in telling the story of the Earth and its life in a simple, straightforward way that keeps one's interest sustained throughout the entire reading.

"We should then welcome anyone who, like the present author, has the ability to clothe the facts of our science in attractive garb and tell the story in such simple terms and with such deft touch as we find in the following pages."

This reviewer fully agrees with Doctor Glenn's praise of this work. The story explains the origin of the planets on the basis of the tidal disruption theory, traces the earth's development until it becomes habitable, and then outlines the history of life on it. Emphasis is on the development and early history of man and only the spectacular side lines, are treated in detail.

The illustrations, by R. E. Falconer, are, on the whole, adequate though the scale is not always correctly indicated (*Diatryma*, for example). More serious is the conflict between the text and the terminal "Chart of Geologic Time" in the relative number of years assigned to the various periods and eras. In the text (p. 58) Paleozoic era is said to have begun 450 million, and the Cenozoic era (p. 154)., 40 million years ago. In the chart they are 550, and 55 million years ago! Paleontologically speaking such age discrepancies are but the expression of our uncertainty in this matter, but here, where the author indicates the relative relationship of events solely in terms of "years ago" the reference use of the chart becomes misleading. This error can easily be corrected in subsequent editions.

Here is an exciting story, thrillingly and enthusiastically, but simply, told.

H. E. VOKES.

ANIMAL BEHAVIOR

- - - - - - - - - by J. A. Loeser

Macmillan, $2.00

PROFESSOR LOESER rightly objects to explanations of animal behavior involving "the assumption of a pre-formed mechanism which functions with unconscious purposiveness and pursues and attains a specific biological aim with automatic certainty." He believes, on the contrary, that the behavior of animals is a product of learning and individual experience. Unfortunately this interesting thesis is supported almost exclusively by anecdotal evidence and anthropomorphic speculation. To assert that the amoeba possesses consciousness and seeks out pleasurable sensations does not add to a general understanding of the reactions of unicellular organisms. The description of a mother bird's care of her brood as "altruistic in the uusual sense of the word" contributes nothing to our knowledge of bird behavior.

Misstatements of fact detract from the book's interesting accounts of the habits of animals. The parturient kangaroo is said to use her lips in transferring newborn young to the pouch. Recently published observations discredit completely this long-accepted belief. According to Doctor Loeser, even reproductive behavior is learned rather than instinctive and cannot occur without previous experience. Such a statement reveals ignorance of numerous experiments proving the normality of mating behavior of animals raised in isolation.

The purpose of the book is creditable, but its actual contribution is small.

FRANK BEACH.

INSECTS AND THEIR STORIES

- by Harry Hoogstraal with camera studies by Melvin Martinson

Crowell, $2.00

FORTY-SIX insects or groups of insects are discussed rather briefly, and each discussion is accompanied by a reproduction of an enlarged photograph. Some of these reproductions are decidedly lacking in detail. The text is apparently intended for those who know little or nothing concerning insects. As such, it may well serve as an introduction to the habits of some of the insects that are frequently noticed. The dimensions of the pages, 9.5 inches wide and 7.5 inches high, makes an awkward format that does not fit well in ordinary bookcases.

ALL IN A LIFETIME

by Frank Buck with Ferrin Fraser

McBride, $2.75

As the name implies, this book is Frank Buck's autobiography. Born in the state of Texas, in a wagon yard owned by his father, Frank Buck always felt a desire to see what was beyond the horizon. As a boy he tried his hand at cattle raising, but the urge to move farther afield was in him and when a chance came to deliver some cattle at Chicago he jumped at the opportunity. While working as a bellhop in a hotel at Chicago, he met Amy Leslie, a dramatic critic on one of the Chicago newspapers. They were later married, but only after he had secured another position with a music publishing house. Through this union Buck became acquainted with many prominent theatrical celebrities, which stood him in good stead during his later life.

But the call to far horizons was strong and when an opportunity came for a trip to South America he broke off all his relations in Chicago and departed. He amassed a considerable collection of birds and animals and had no difficulty in disposing of them when he returned to the United States. And thus the career was begun which was to make Frank Buck famous. Since that time he has brought back many thousands of mammals, birds, and reptiles, chiefly from the Malay Peninsula and India.

Frank Buck is not only a good collector but also a good showman, and the latter trait undoubtedly contributes to his popularity. His three pictures, ***Bring 'Em Back Alive***, ***Wild Cargo***, and ***Fang and Claw***, were very popular. In making these pictures he resorts to all sorts of devices that might be fair in Hollywood but are not considered true natural history. I have been in the locality where some of his pictures were taken, and this fact is common knowledge there.

The book is written in an entertaining vein and holds the interest of the reader throughout. Numerous pictures, chiefly of Frank Buck, illustrate the book. T. D. C.

MUD, STONES, AND HISTORY

Continued from page 296

Taking the continents of North and South America as a whole, we find that the highest and most stable culture occurred in Central America. By the same token we also find that our most primitive and least stable cultures are found at such opposite extremities as Tierra del Fuego to the south, and certain Eskimo lands to the north. Prior to the time Nelson was able to develop the concentric circle scheme of cultural Age and Area, it had been supposed that Tierra del Fuego was a recent culture. But according to the new hypothesis, such is not the case. The natives of Tierra del Fuego all represent the outermost southward ripple resulting, so to speak, from the stone thrown in the water of the Mexican corridor. They are therefore the least affected by pre-Columbian achievements and represent approximately the selfsame cultural level at which primitive man had arrived when he reached the American continent.

Nelson is of the opinion that these original tribes came over by way of the Bering Straits, some 12,000 years ago. Although he is not unappreciative of the scattered cultural evidences suggestive of occasional immigrants from Polynesia to the American coast, he feels that their traits obviously arrived in relatively recent prehistoric times and have no bearing on the original peopling of the American continent.

The future

A man who has done so much for the science of archaeology can well afford to sit back at this stage of the game and speculate as to what may happen to that science in the future. Archaeology has been so publicized of late that he feels too much attention has been paid to the supposedly romantic field work and not enough to the prosaic classification of the collections once they are housed in the Museum. Every young man, he avers, wants to wield the pick, and every young girl wants to put on jeans and get into the dirt. This is all well and good, but for financial and other cogent reasons, the center of emphasis in archaeology must shift from field work to the laboratory and the exhibition hall.

Such a manifest destiny is due in no small part to Nelson's own work. The fundamental principles that he has established enable the workers of the present day to tell pretty well in advance what they are going to get from a given locality. People in responsible positions need therefore assign only that work which is still to be done and thus guard against a duplication of essentially identical material from many different regions which would only add unnecessary weight to conclusions already well substantiated. It must not be supposed, however, that Nelson would have all excavation work cease immediately. He merely suggests that students reserve some of their ardor for the laboratory. And his view of this matter has doubtless been colored by the confused state of the collections bequeathed by his predecessors.

This might seem to bear out those critics of Museum activities who say that the institution is foundering in a welter of ineptitude. But the real difficulty is that there are not enough curators to cover all the exhibition halls. Nelson himself is responsible for all the archaeological halls in the American Museum except those of Latin America. And it simply takes his entire time to keep them up-to-date, a task at which he feels much like that denizen of Hades who kept pushing the rock up the hill only to have it roll down to the bottom again.

Nelson takes the public exhibitions of artifacts very seriously and earnestly strives to make everything as clear as possible to the general public. He is therefore gratified by the recent announcement that the Trustees of the Museum have put forward a program for modernizing the exhibition of material under his jurisdiction.

With such undertakings we may expect Nelson to become more and more identified in the future. Though he accepts this sedentary burden philosophically enough, he cannot help but cast a nostalgic eye over the trophies of his exploring days with which his office abounds, including an enlarged model of the Chinese junk on which he sailed up the Yangtze as Admiral Nelson.

But he is not the sort that thrives on memories. Let us hope, therefore, that some day—when he has gotten all his papers published and all his vast collections clarified for the use of specialists and public alike—Nelson will once again set forth for the diggings.

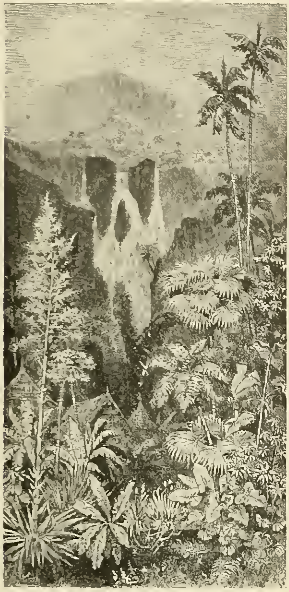
"No man," says Walter Granger, "ever had a better field companion than Nels. If I were going out on a desert island where I would have to be satisfied with the company of only one man, I'd choose him. Of all the camp mates I've had in 50 years of exploration, he is the only one who did not have some little trait or other which I knew would sooner or later rub me the wrong way. The most wonderful thing about him, I think, is that he knows when to talk and when to keep quiet, and that is an art few people ever learn."

No scientist could wish for higher tribute.

LETTERS

Continued from page 245

lowing description in German: "First waterfall of the Caroni River in the vicinity of its source in Mount Roraima on the



Venezuela and British Guiana boundary." The flat-topped mountain pictured is so strikingly similar to the country photographed by Mr. Gilliard's party that the illustration could hardly be the product of poetic imagination. . . .

J. R. MULRYAN.

Baguio, Philippine Islands

Mr. Gilliard, the author of the article, is convinced that the waterfall depicted is not Angel Falls but one in the region of Roraima as specified, 120 miles away. It is interesting to note that even today, with the region fairly well mapped, no waterfall is generally recorded on the upper Caroni, but falls are numerous in the region and are chiefly known by local names.—ED.

* * *

SIRS:

I have just received the December number of NATURAL HISTORY. In the list of "World's Highest Waterfalls" you do not mention any Iceland waterfalls, although there are several over 100 feet. I can mention that Dettifoss is 257 feet and very large.

WILLIAM F. PALSSON.

Laxardal *via* Husavik, Iceland.

NATURAL HISTORY gratefully acknowledges the addition of this information to its catalogue of the world's waterfalls. Owing to the scarcity or inaccessibility of data in geographic literature as well as to restrictions of page area, NATURAL HISTORY was not able to include all the high waterfalls of the world, but alert readers are adding valuable facts to the list.—ED.

* * *

SIRS:

I have long been accumulating a fund of enthusiasm for your magazine and it has reached the bursting point with the last two issues. There is such a lot of extremely interesting reading, and all beautifully illustrated. And especially the covers! You have certainly solved the cover problem better than any other magazine I know about. They are all "natural history" and wonderfully arresting, as the tiger on the February issue, or beautiful as the one for March.

That March cover simply takes my breath away with its beauty. . . .

MRS. H. W. SHIMER.

Hingham, Mass.

(Right) THE INDIANS are said to have marked their trails by bending saplings in the required direction. But this tree was not such a marker to indicate a right turn. In reality it is an ailanthus tree that has been assailed by a honeysuckle vine and has solved its dilemma in the Chinese manner—by "absorbing" the conqueror.

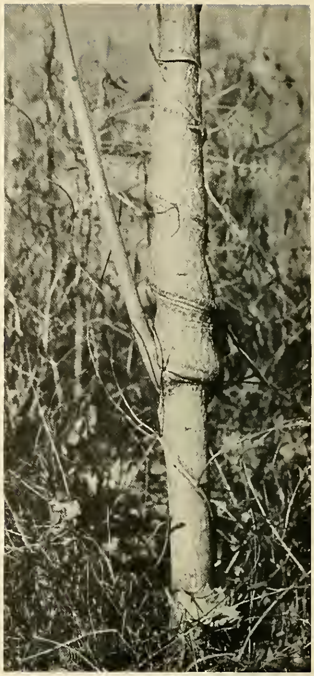


Photo by Herbert Beatty

"COURTING"—An unusual pose caught by Morris W. Wilsey of Oakland, California. Photograph taken at $\frac{1}{50}$ second and f: 11 with a K2 filter

NOTICE Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.